
Spirent Communications Nomad User's Manual

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Notice:

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Notice:

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Changes or modifications to the Nomad hardware not expressly approved by Spirent Communications, Inc. may void the user's authority to operate the equipment.

Notice:

Spirent's Nomad ME hardware contains FCC certified transmitter modules FCC ID R47F2M03MLA.

Spirent's Nomad HD ME hardware is FCC certified under the FCC ID WR2-NOMADHD-01.

Notice:

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada.

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1 Introduction

Spirent Communications Nomad provides a comprehensive and efficient measure of real-world mobile device performance by automating high-volume call control testing sequences and voice quality characterization on virtually any Bluetooth-enabled handset, regardless of wireless technology or device model.

Spirent Nomad allows you to:

- Reduce the manpower cost of collecting both voice quality and call performance data for testing through automation
- Provide statistically repeatable and reliable results to impact device changes
- Capture poorly performing devices prior to market launch
- Improve device quality, user experience and brand perception

In the Nomad system, mobile handsets make calls to and receive calls from centralized voice and call servers. All servers are managed through a PC-based interface. The servers collect and store call record and degraded audio information which is merged with locally stored results at test completion for a comprehensive view of device performance.

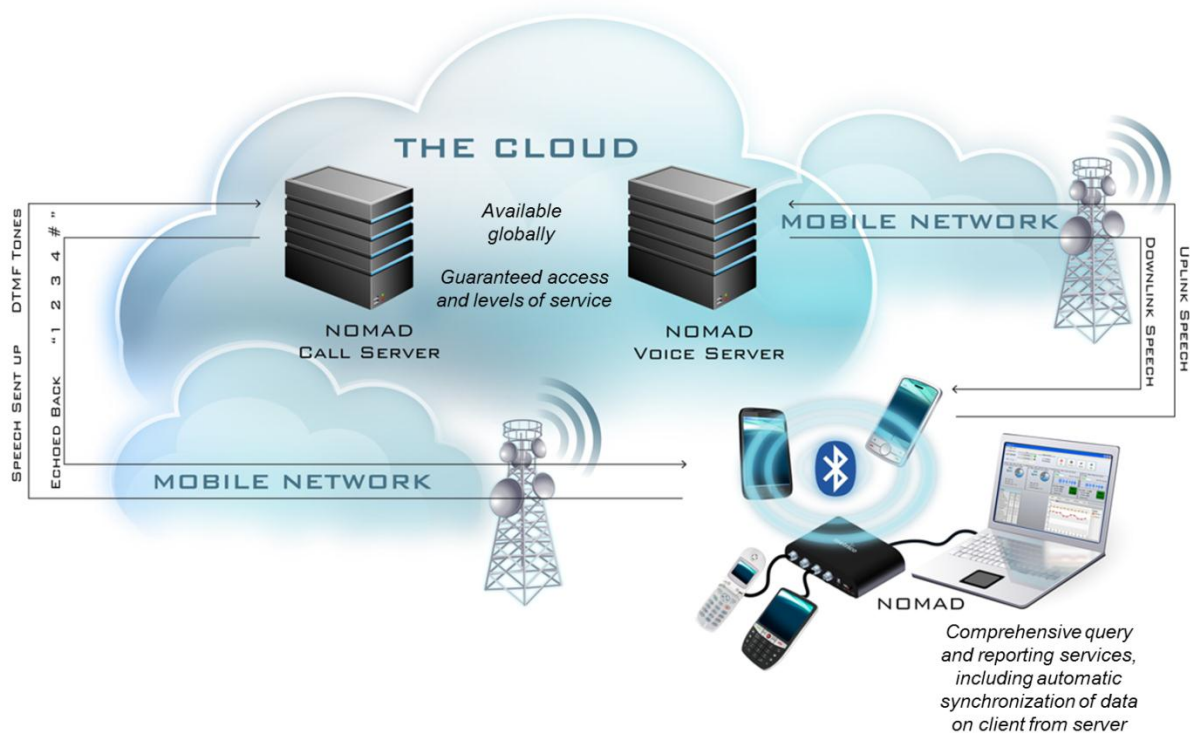


Figure 1-1 - Nomad System Overview

The metrics available as outputs from the Nomad system include:

- Voice Quality (Uplink and Downlink)
- Voice Delay
- Call Initiation Performance (Mobile Originated and Mobile Terminated Calls)
- Call Retention Performance (Mobile Originated and Mobile Terminated Calls)
- Call Setup Time
- Loss of Network
- Bluetooth Voice Performance

This document describes the setup and operation of the Spirent Nomad system for all voice quality, Bluetooth and call performance functionality. All testing is performed by controlling the Spirent Mobile Equipment (ME) using the Nomad software interface. This document describes the setup and operation of the Spirent Nomad system for all test types.

2 Nomad System Configuration

The Spirent Communications Nomad system contains both hardware and software for mobile performance evaluation. Prior to installing Nomad for the first time, please verify that all hardware components are present, including a laptop meeting the Nomad computing requirements. Also note that when setting up the Nomad system for the first time, the software must be installed prior to connecting the hardware. The following sections describe the system configuration process.

2.1 System Component Verification

The standard hardware components shipped with Nomad systems are:

- Spirent Nomad HD ME–or- Spirent Nomad ME hardware unit
- GPS receiver
- USB cable
- Six-foot TRS 2.5 mm audio cables – one for each licensed channel (up to four narrowband cables and four HD cables)
- AC adapter
- Cigarette lighter adapter
- Calibration cable

The Bluetooth profiles used by Nomad are:

- Hands-Free Profile (HFP) 1.5
- Hands-Free Profile (HFP) 1.6 (For Nomad HD ME hardware only)
- Headset Profile (HSP) 1.1

A laptop computer and up to four test mobiles, not supplied, are also required to work with the Nomad system. Any computer used with the Nomad system must meet the Nomad minimum computing requirements:

Computing Requirement	Optimal Performance	Minimal Performance
Processor	Intel® Core™ i7	Intel® Core™ i5
RAM	8 GB	4 GB
Free Disk Space	20 GB	10 GB
Operating System	Windows XP, Vista or 7	Windows XP
USB Drive	N/A	USB 2.0 Drive
Software	N/A	<ul style="list-style-type: none"> • Microsoft .NET Framework 3.5 SP1 (See Section 2.1.1) • Microsoft Excel 2007 or higher (for the Report Generator); alternatively, download Microsoft Excel Viewer to view the .XLSX output reports • User Account Control setting disabled on Windows Vista and 7 machines (See Section 2.1.2) • User must be logged in as a Windows Administrator. Nomad will not run under a non-admin login.
Dedicated High Speed Internet Connection	N/A	<p>Sustained internet connection of at least 50 kbps is required for the following situations:</p> <ul style="list-style-type: none"> • Determining optimal volume levels for a voice quality test using Automatic Level Assist • Viewing live uplink data during a voice quality test • Starting a Mobile Terminated call campaign • Obtaining the report for a Mobile Terminated or Voice Quality call campaign • Automatic internet-based time sync during testing (GPS time sync is recommended)

2.1.1 Microsoft.NET Framework 3.5 SP1

The Nomad software application requires Microsoft.NET Framework 3.5 SP1. Although the Nomad software installation includes Microsoft.NET Framework 3.5 SP1, Spirent Communications recommends performing a manual check for this component. To verify the current version of Microsoft.NET:

- From the **Windows Start Menu** select **Settings** → **Control Panel** → **Add or Remove Programs (Programs and Features** in Microsoft Vista)
- Verify that Microsoft.NET Framework 3.5 SP1 is installed

If Microsoft .NET Framework 3.5 SP1 is required:

- Browse to the Microsoft.NET Framework download site:
<http://www.microsoft.com/downloads/details.aspx?FamilyID=ab99342f-5d1a-413d-8319-81da479ab0d7&DisplayLang=en>
- Follow the instructions to install

2.1.2 Disable User Account Control (Windows Vista and Windows 7)

The Nomad software application requires that the **User Account Control (UAC)** setting be disabled on Windows Vista and Windows 7 machines.

To disable UAC in Windows Vista:

- From the **Windows Start** menu select **Settings** → **Control Panel**.
- Under **User Accounts and Family Safety** select **Add or remove user accounts**.

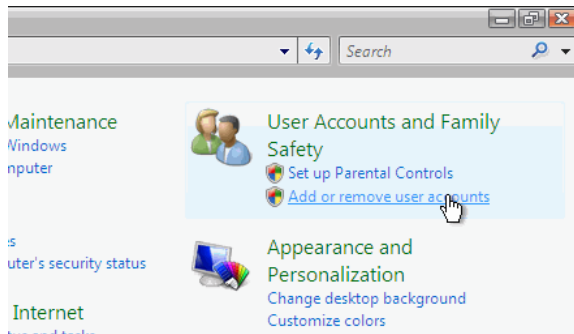


Figure 2-1 - User Accounts and Family Safety Area

- Click on any user account (i.e. the Guest account).
- In the list of user account options, select **Go to the main User Accounts page**.

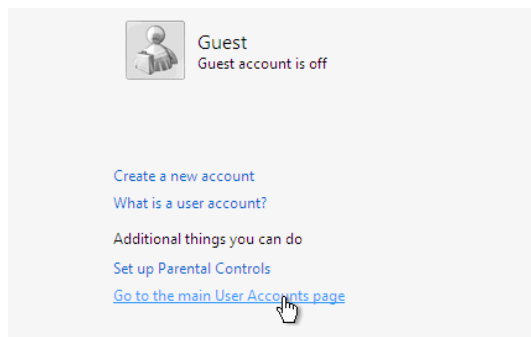


Figure 2-2 - User Account Options

- Under **Make changes to your user account**, select **Change security settings**.

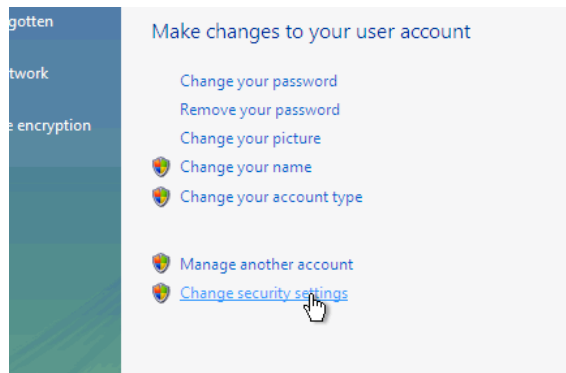


Figure 2-3 - Make changes to your user account

- Deselect **Use User Account Control (UAC)** to help protect your computer.

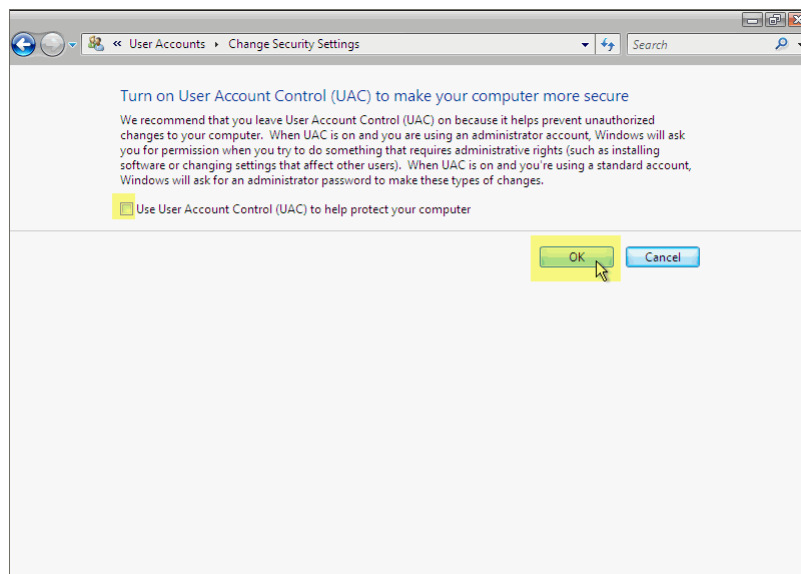


Figure 2-4 - User Account Control Screen

- Click **OK** to confirm your selection.
- When prompted, restart your computer to apply the changes.

To disable UAC in Windows 7:

- From the **Windows Start** menu select **Settings** → **Control Panel**.
- Under **User Accounts and Family Safety** select **Add or remove user accounts**.

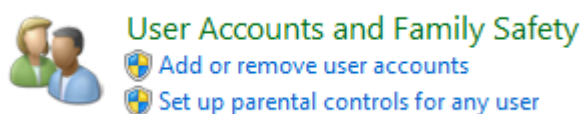


Figure 2-5 - User Accounts and Family Safety Area

- Click the **User Accounts** link.

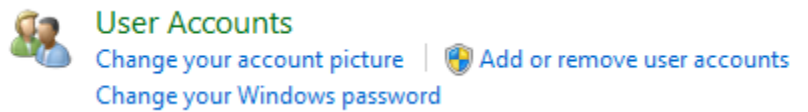


Figure 2-6 - User Accounts Area

- In the list of user account options, select **Go to the main User Accounts page**
- Select the **Change User Account Control Settings** option.

Make changes to your user account

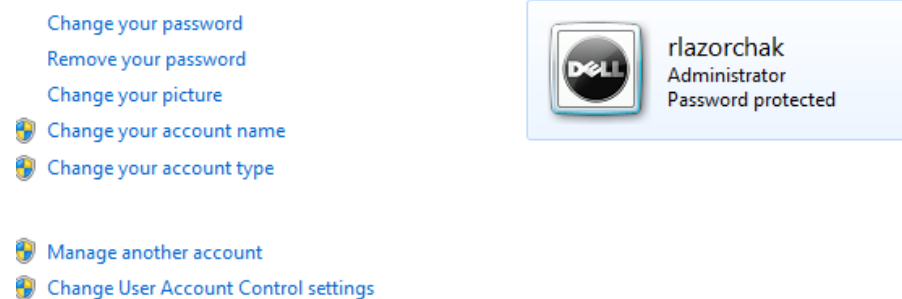


Figure 2-7 – Make changes to your user account Screen

- Lower the notification bar from **Always notify** to **Never notify**.

Choose when to be notified about changes to your computer

User Account Control helps prevent potentially harmful programs from making changes to your computer.

[Tell me more about User Account Control settings](#)

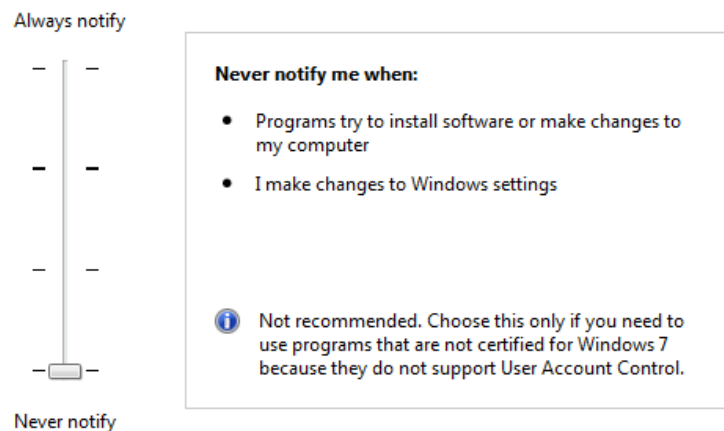


Figure 2-8 - User Account Control Screen

- Click **OK** to confirm your selection.
- When prompted, restart your computer to apply the changes.

2.2 Software Installation

The Nomad installation file may be obtained from your Spirent Communications representative. Once you have the Nomad installation package:

- Unzip the package (if applicable) and click on **Setup**.
- Follow the instructions to complete the software installation.

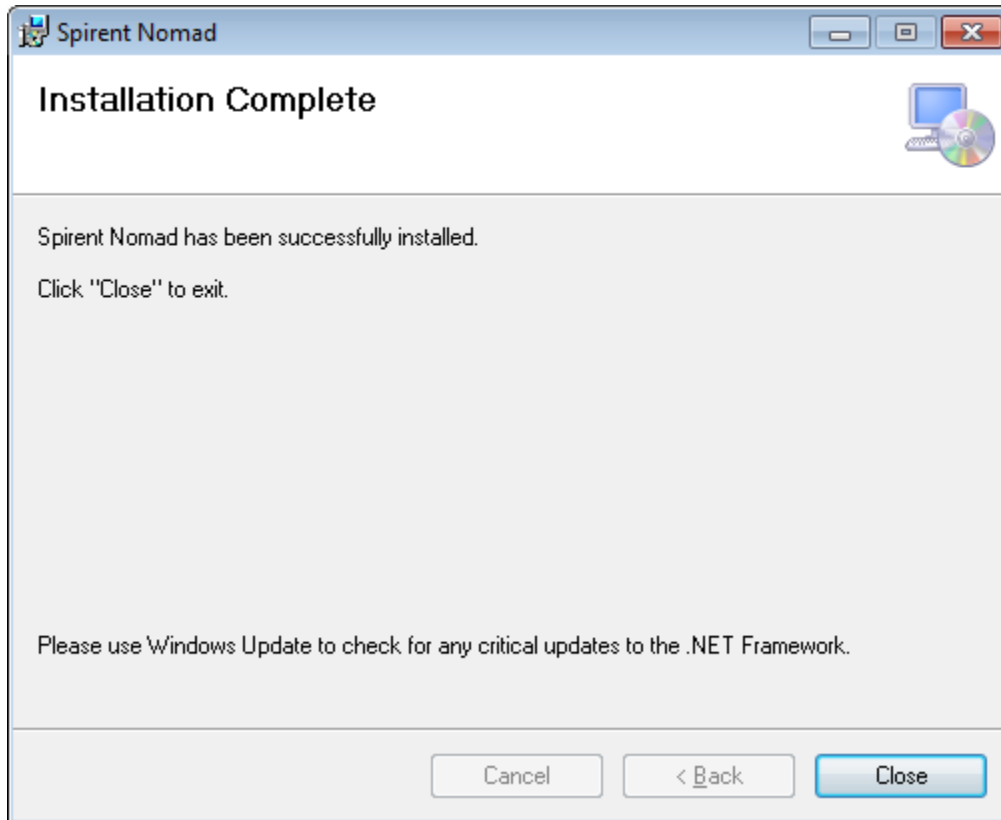


Figure 2-9 - Nomad Installation Complete

After Nomad has been installed, the software will inform you automatically when upgrades are available provided that:

- The computer running the Nomad software is connected to the internet.
- The Nomad hardware is attached.
- Support and maintenance is up-to-date for the Nomad license in use.

2.3 Hardware Installation



Figure 2-10 - Spirent Communications ME and HD ME Hardware Units

Configure the Spirent ME or Spirent HD ME hardware by making the following connections:

- Plug in the **AC Adapter** and connect to the **+12V** port on the Spirent Nomad unit.
- Connect the **GPS Receiver** to the **GPS** port.
- For analog voice quality testing, connect the audio cables to the desired licensed channel ports on the front of the unit (**Channel 1, Channel 2**, etc.). The test handsets will be connected later during the data collection process.
- Connect the **USB laptop cable** to the **PC** port on the Spirent ME unit.
- With the laptop turned on, connect the other end of the **USB laptop cable** to the USB port on the computer. Take note of this port so that you always connect the hardware unit to the same port.
- Make sure that test handsets are available. The handsets will be connected during the session configuration process.

The USB hardware detection will take place upon the first connection. A notification will be displayed when the automatic driver installation procedure is complete.

To confirm that the driver has been installed, look for the **Metrico Devices → Metrico ME Device (for ME devices) or Spirent Communications Devices → Spirent HD ME Device (for Spirent HD ME devices)** in the **Windows Device Manager**.

At this time the system is configured and ready for mobile performance testing.

3 Application Workflow

This section provides an overview of the Nomad workflow:

- Open the program
- Specify Nomad settings
- Define the test by assigning tasks to channels and modifying task settings
- Initiate the test
- Monitor the test in progress
- Analyze the results

The testing process is illustrated in **Figure 3-1**. The following sections of this document describe the detailed procedures used in working with Nomad.

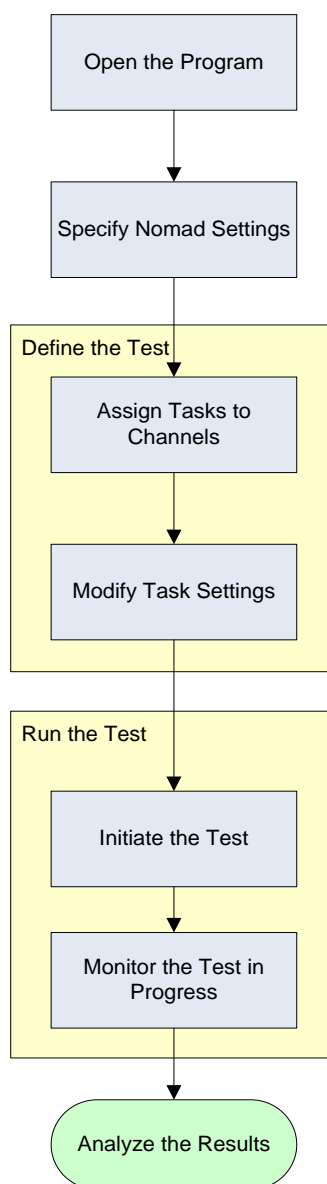


Figure 3-1 - Nomad Application Workflow

4 Specifying Nomad Settings

Prior to first use, Nomad must be configured with user preferences. Configuring the program consists of:

- [Specifying General Settings](#)
- [Specifying GPS / Time Settings](#)
- [Specifying Call Performance Settings](#)
- [Specifying Voice Quality Settings](#)
- [Specifying Email Campaign Settings](#)

Each of these configuration options is accessible from the Nomad **Settings** tab.

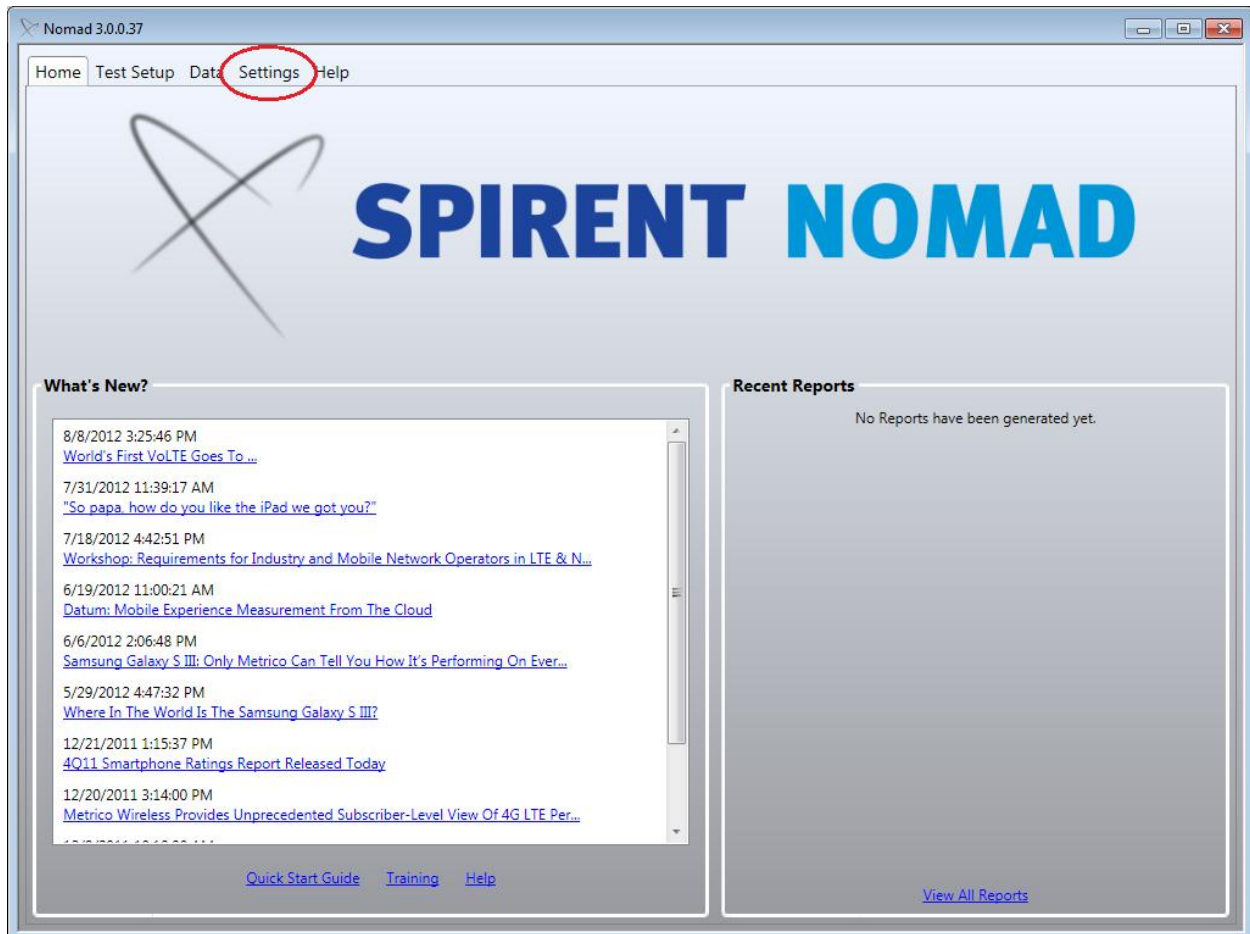


Figure 4-1 – Locating the Nomad Settings Tab

4.1 Specifying General Settings

To specify general settings for Nomad on the **General** settings tab:

- Choose whether to **Check for updates** on application startup to determine whether a newer version of Nomad is available (recommended).
- Choose whether to **Check for new utilities** on application startup to check for newer versions of installed utilities and to find new utilities (recommended).
- Choose whether to **Output local time when generating reports**. If this option is left unchecked, time will be listed in UTC in Nomad output reports.
- The **Enable Remote Control via TCP socket 7072** option will be visible only to customers who have purchased this optional command set for controlling Nomad remotely via any Socket Client. This option should be selected in order to access Remote Control functionality. Remote functionality includes:
 - Time synchronization
 - Specification of output file name and location
 - Starting / stopping a recording session
 - Displaying MOS results on a remote client
- The **Require Hardware Identifiers** option, when checked, will prevent launching a test if the Hardware Identifier field on any enabled channel's Device Info dialog is not filled in.

Please contact a Spirent representative if you are interested in learning more about Nomad Remote Control.

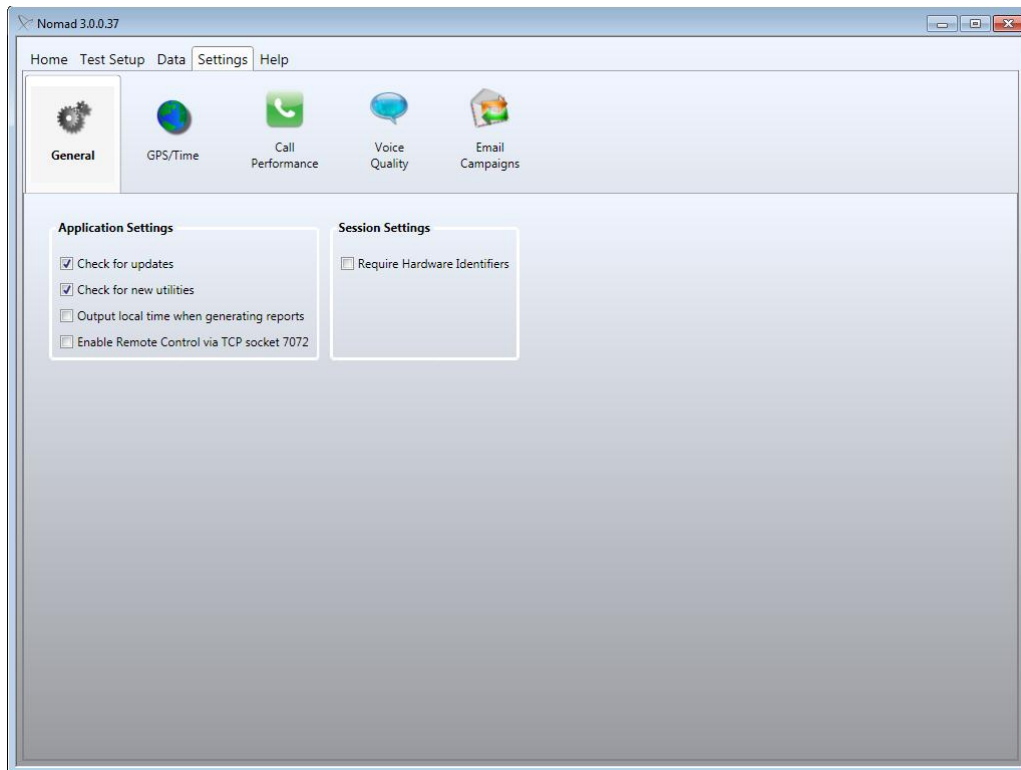


Figure 4-2 - General Settings

4.2 Specifying GPS/Time Settings

Specify settings related to time synchronization and GPS on the **GPS/Time** tab. The **Automatic Time Synchronization** and **GPS** areas are discussed in detail below.

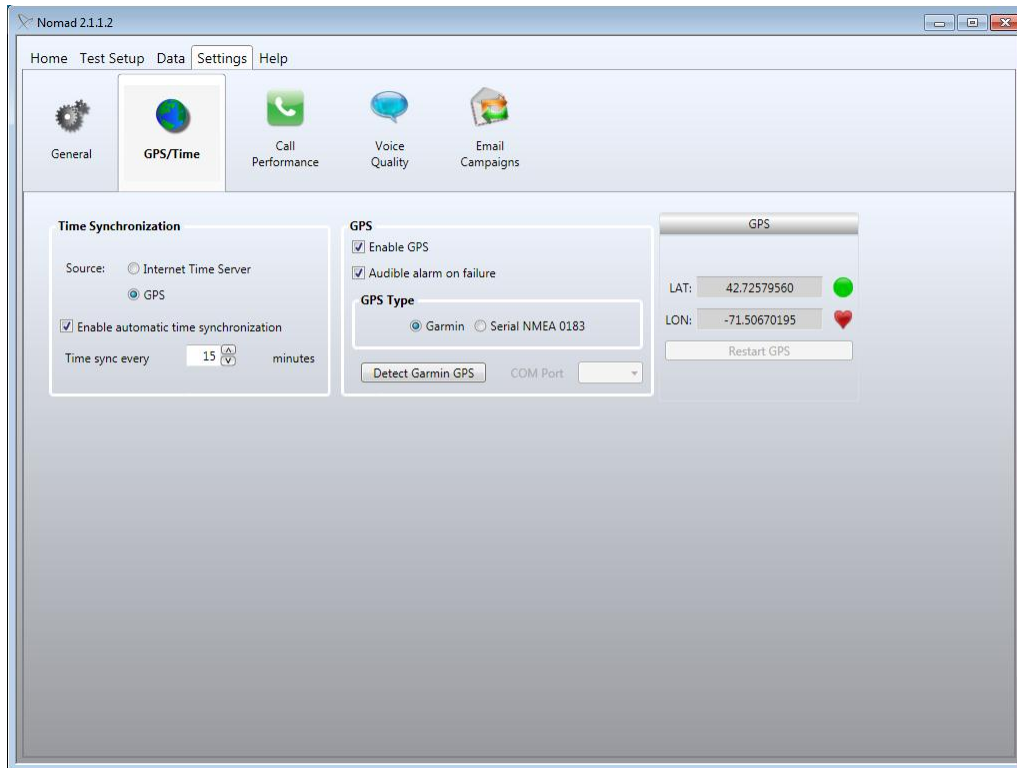


Figure 4-3 - GPS/Time Settings

4.2.1 Time Synchronization

The successful use of the Nomad system is strictly dependent on consistent timing between the test laptop and the Audio or Call Server. Time synchronization is critical in the case of a Voice Quality or Mobile Terminated Call Performance campaign. To specify time synchronization options:

- Select the time synchronization **Source**. The time synchronization source is used as the method of automatic time synchronization and the first method attempted in the initial time synchronization performed prior to testing.
 - **Internet Time Server** – Nomad will synchronize the PC's clock to internet time on demand. In order to use this method, you must have a dedicated internet connection.
 - **Note:** Spirent does not recommend using this method for Voice Quality testing performed while drive testing. Substantial latency may be introduced when the internet time protocol operates in a mobile environment. If possible, use GPS synchronization in this case.
 - **GPS** – Nomad will synchronize to the appropriate server using GPS time. Spirent recommends using this time synchronization method when GPS is available, particularly in the case of Voice Quality tests performed while drive testing.



- Check **Enable automatic time synchronization** to prevent time drift in synchronization between the test laptop and the Voice or Call Server. This option requires that you have access to the time synchronization source (internet or GPS) during testing.
- Set the period between time synchronization updates in minutes. Spirent recommends setting this to 5 minutes for frequent updates. Note that time synchronization during testing has no impact on data collection or performance.

4.2.2 GPS Settings

Nomad can record GPS information during testing. Location information may be used to display data testing results graphically in MapInfo™ and similar mapping applications (see [Section 8.4](#)). GPS may also be used as the Time Synchronization method as described in [Section 4.2.1](#). To capture GPS information with Nomad:

- Connect the GPS device and enable the device to acquire a signal.
- In the **GPS** area of the **GPS/Time** dialog, confirm that the **Enable GPS** box is selected.
- If desired, enable the **Audible alarm on failure** of the GPS.
- Select the **GPS Type** as **Garmin** or **Serial NMEA0183** (for DeLorme or any device that supports this standard). For a serial device, select the corresponding **COM Port**.

If available, live GPS data will be displayed here:

- The current latitude and longitude are displayed.
- The **GPS FIX** status is given by the colored circle in this area. Hover over the circle for the status tooltip. The status is provided as **NO FIX**, **2-D DIFF**, **3-D** or **3-D DIFF**. **DIFF** status refers to a lock on differential GPS sensors, providing a slightly more accurate location reading than standard GPS.
- The **blinking heart**  indicates that Nomad is receiving messages from the GPS. The heart blinks each time a GPS message is received.
- The **yellow triangle**  indicates that an error has occurred. Click the **Restart GPS** button to activate (in some cases it may be necessary to click this button twice).

4.3 Specifying Call Performance Settings

Specify settings related to Call Performance testing on the **Call Performance** tab. The different areas of this tab are discussed in detail below.

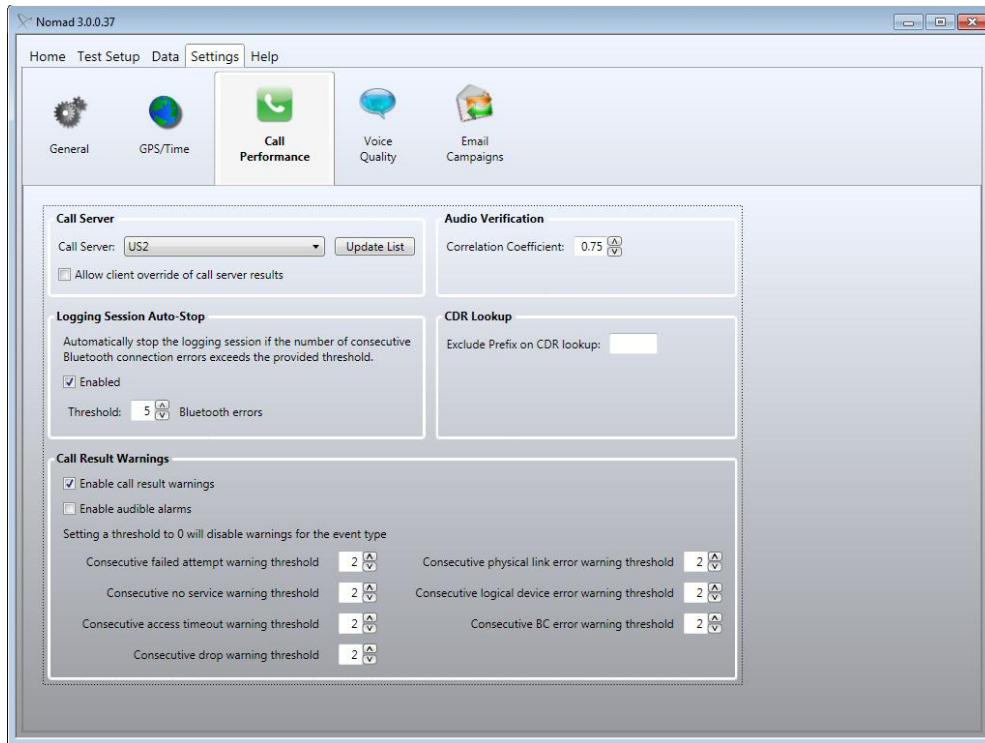


Figure 4-4 - Call Performance Settings

4.3.1 Call Server

In the **Call Server** area, select the geographically relevant **Call Server**. By dialing and receiving calls, and by collecting and storing call record information, the Call Server facilitates both Mobile Originated and Mobile Terminated call performance sequences.

The **Allow client override of call server results** option was implemented for a small group of international customers facing an unreliable landline infrastructure. This option should be left unchecked unless otherwise instructed by the Spirent Product Support Team.

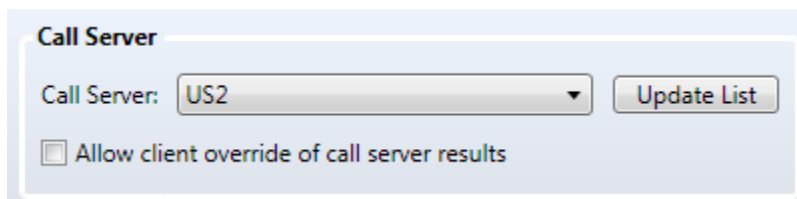


Figure 4-5 - Call Server Area

4.3.2 Logging Session Auto-Stop

Spirent provides the ability to automatically stop the entire logging session if the number of consecutive Bluetooth connection errors on any test device exceeds the provided threshold. This check ensures that a user does not conduct an extended test using a non-functioning device, possibly invalidating results for the entire test array. To configure **Logging Session Auto-Stop**:

- Choose whether to enable this functionality (recommended).
- Set the **Threshold** for the number of consecutive Bluetooth errors which constitutes stopping a test.

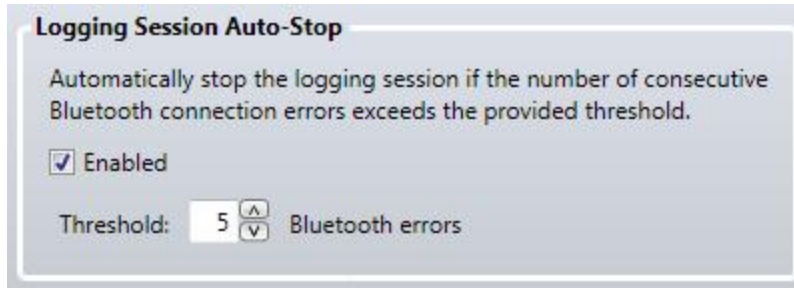


Figure 4-6 - Logging Session Auto-Stop Area

4.3.3 Audio Verification

Nomad provides Audio Verification data for Call Performance tasks by determining the correlation value of audio sent to the Call Server from the test mobile and audio echoed back. The correlation coefficient is a threshold at which audio will be considered matching. This number should remain unchanged, unless directed by Spirent.

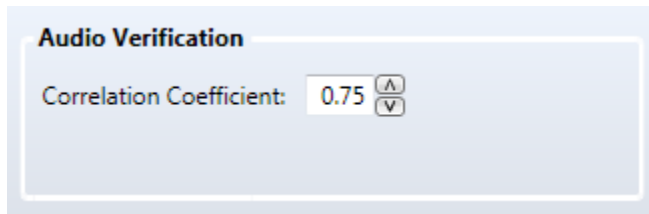


Figure 4-7 - Audio Verification Area

4.3.4 CDR Lookup

In the CDR Lookup area, select the part of the dialed number (from the viewpoint of the call server that Nomad is calling) that should be excluded when Nomad contacts the call server to retrieve Call Detail Records.

This is an advanced setting that can be used when the Call Performance testing is performed in one country and the call server resides in another – the Caller ID of the device that is calling the call server can under certain circumstances look different than the number that was dialed.

The CDR Lookup setting can be used to indicate that prefixes (international dialing prefixes or similar) should be excluded when matching telephone numbers for uplink score retrieval.

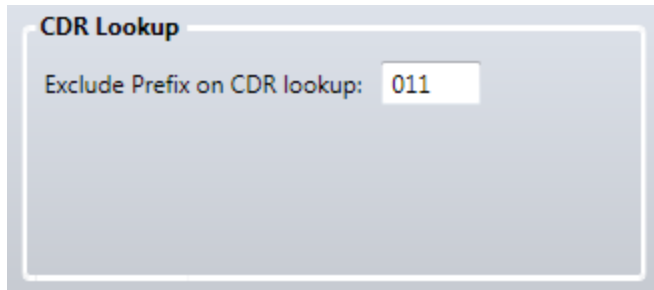


Figure 4-8 – CDR Lookup area

4.3.5 Call Result Warnings

Select whether or not to **Enable call result warnings** and to **Enable audible alarms** for these warnings. Warnings will occur when the consecutive number of events exceeds the user-defined threshold for each of these event types:

Call Outcome	Definition
Failed Attempt	<ul style="list-style-type: none"> A <i>Mobile Originated Call</i> was placed and an outgoing call was established followed by the phone's return to the call placement state.
No Service	<ul style="list-style-type: none"> There was no service available when the call was attempted.
Access Timeout	<ul style="list-style-type: none"> <i>Mobile Originated Call</i> – A call was placed but no state change occurred before the Access Timeout time. <i>Mobile Terminated Call</i> – The connection did not take place before the Access Time.
Dropped Call	<ul style="list-style-type: none"> The call was ended before the expected duration had elapsed.
Physical Link Error	<ul style="list-style-type: none"> The Bluetooth connection between the test mobile and the Nomad hardware unit was not active at the time a call was supposed to occur.
Logical Device Error	<ul style="list-style-type: none"> The test mobile failed to respond properly to a command issued by Nomad via the Bluetooth connection.
BC Error (BlueCore Error)	<ul style="list-style-type: none"> The Bluetooth module was not in a nominal state at the time a call was supposed to occur.

Call Result Warnings

☒ Enable call result warnings

☐ Enable audible alarms

Setting a threshold to 0 will disable warnings for the event type

Consecutive failed attempt warning threshold 2 ▲▼

Consecutive no service warning threshold 2 ▲▼

Consecutive access timeout warning threshold 2 ▲▼

Consecutive drop warning threshold 2 ▲▼

Consecutive physical link error warning threshold 2 ▲▼

Consecutive logical device error warning threshold 2 ▲▼

Consecutive BC error warning threshold 2 ▲▼

Figure 4-9 - Call Result Warnings Area

4.4 Specifying Voice Quality Settings

Specify settings related to Voice Quality testing on the **Voice Quality** tab. The different areas of this tab are discussed in detail below.

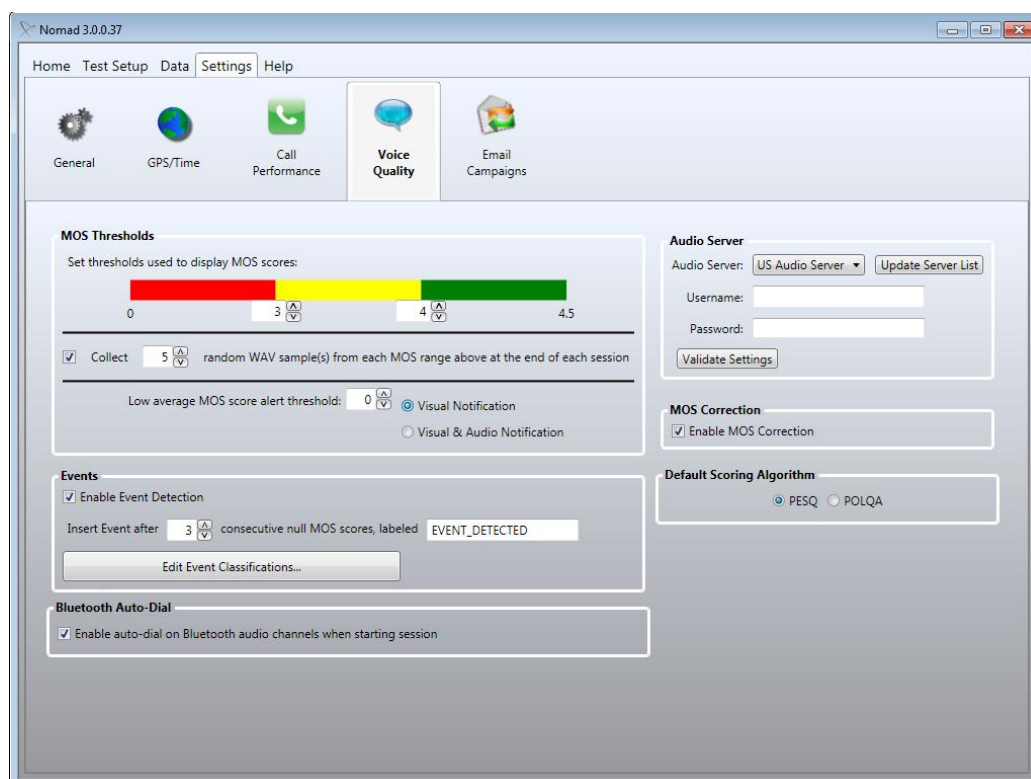


Figure 4-10 - Voice Quality Settings

4.4.1 MOS Thresholds

Use the settings in the MOS Thresholds area to customize data views according to local performance criteria:

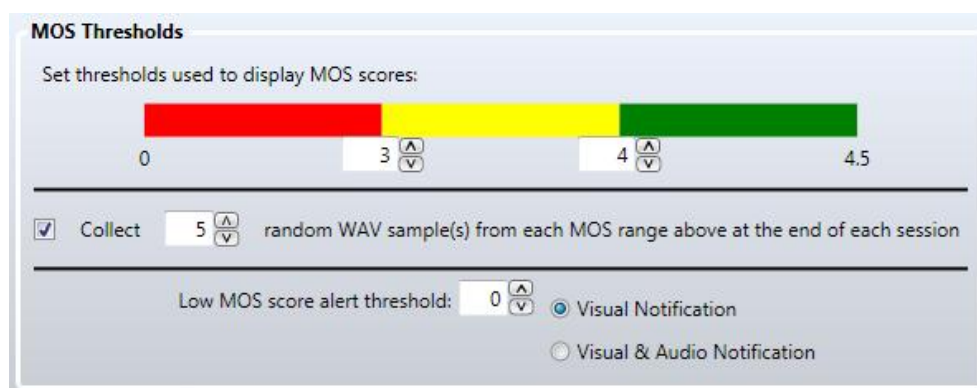


Figure 4-11 - MOS Thresholds Area

- Use the **Color Bar** to set the thresholds that determine **Great (green)**, **Good (yellow)** and **Bad (red)** voice quality performance.
- Check **CollectXrandom WAV sample(s) from each MOS range above at the end of each session** to set aside a random sample of audio files within each MOS performance range. This allows the audible verification of **Great**, **Good** and **Bad** audio samples at the conclusion of the test. See [Section 8.5](#) for detailed information on collecting random audio sample files.
- Set the **Low MOS score alert threshold** to a MOS value between 0 and 4.5. When a MOS reading falls below this threshold, Nomad will present either a **Visual Notification** or **Visual & Audio Notification** to the user. Effectively disable this functionality by setting the **Low MOS score alert threshold** to 0.

4.4.2 Events

Events that occur during a test session complement voice quality to provide an overall indication of handset performance. Nomad provides the ability to note events of interest on both a per-channel and per-cycle basis during voice quality testing. Nomad also provides the ability to automatically detect a sequence of null MOS values, often indicative of a dropped call.

- Select **Enable Event Detection** to automatically detect and log null MOS events.
- Select the number of consecutive null MOS scores that constitute a **Null MOS Event** and customize the label for this event.
- Select the **Edit Event Classifications** button to specify custom **Event Classifications** by event names. These events must be manually recorded in the **Events** tab of the **MOS Trends Window** upon occurrence during testing. See [Section 7.2](#) for more information about event logging and event detection during **Voice Quality** testing.

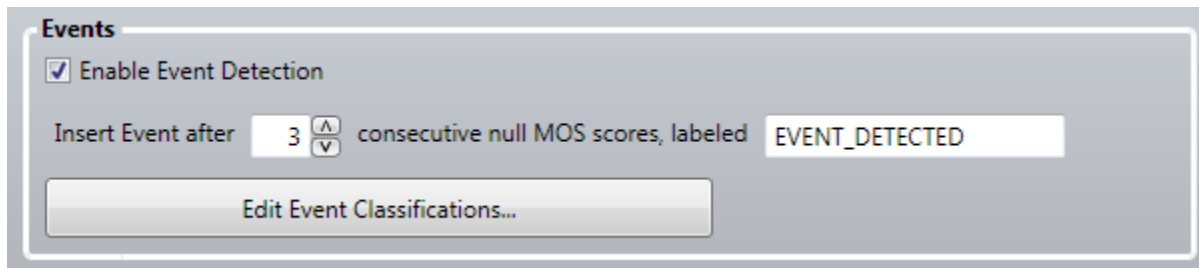


Figure 4-12 - Events Area

4.4.3 Bluetooth Auto-Dial

Check **Enable auto-dial on Bluetooth audio channels when starting session** to allow Nomad to automatically dial the audio server for channels connected using Bluetooth. Spirent recommends that international users dialing a non-US audio server should disable this option as local dialing conventions may be best handled manually.

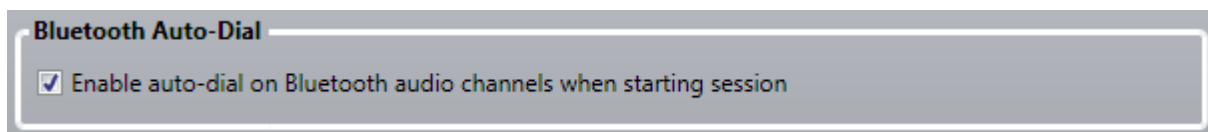


Figure 4-13 - Bluetooth Auto-Dial Area

4.4.4 Audio Server

The Audio Server facilitates voice quality testing by answering calls, sending and recording .WAV files, storing the recorded .WAV files and handling uplink data collection. The Audio Server is an extremely high quality Interactive Voice Response (IVR) service provided by Spirent Communications to answer calls, send and record speech, and store the recorded samples for access to uplink results.

In this area:

- Select the geographically relevant **Audio Server**.
- Enter your Audio Server **Username** and **Password**.
- **Validate Settings** to ensure that the settings are correct for access throughout the test process.

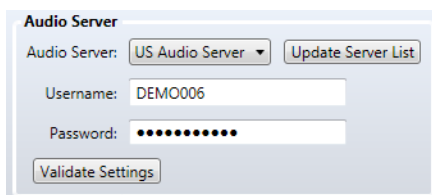


Figure 4-14 - Audio Server Area

4.4.5 MOS Correction

Invalid MOS scores, such as those obtained by comparing an empty .WAV file to a reference file, may drastically skew performance statistics. Invalid MOS values may also be obtained when DTMF (push-button) tones are audible in the recorded speech sample. Selecting **Enable MOS Correction** prevents invalid MOS scores from being reported. This option is enabled by default.

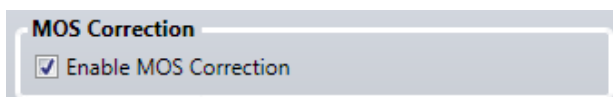


Figure 4-15 - MOS Correction Area

4.4.6 Default Scoring Algorithm

This setting controls the default scoring algorithm for each new voice quality task added to a Nomad channel. Either PESQ or POLQA may be selected. See [Appendix E](#) for an introduction to POLQA including a comparison between PESQ and POLQA.

The default scoring algorithm may be overridden for any individual task when modifying the task settings.

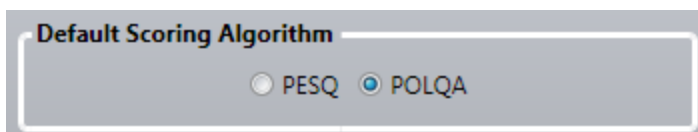


Figure 4-16 - Default Scoring Algorithm Area

4.5 Specifying Email Campaign Settings

An e-mail campaign may be launched during a Voice Quality or Call Performance task to test Multi-RAB performance. An e-mail campaign tests whether e-mail sent to a phone during a call disrupts performance as compared to phones not receiving e-mail. Email campaign settings are specified from the **Email Campaigns** tab.

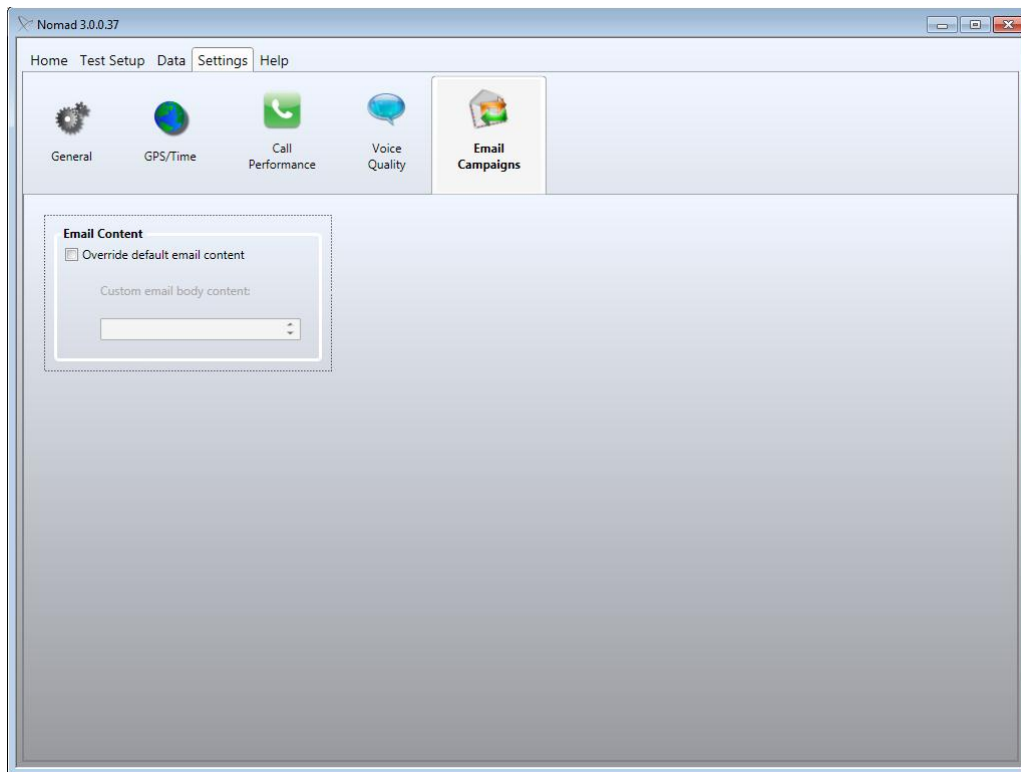


Figure 4-17 - Email Campaign Settings

- Check the **Override default email content** box to specify the content of the body of the emails to be sent to the phone during an email campaign. If this box is left unchecked, Spirent will automatically generate the content for the messages sent in the email campaign.

5 Defining a Test

Nomad provides testing flexibility with a fully configurable Test Setup utility. Users may customize the type of task to be performed on each test channel (per availability based on licensing) as well as task details. When defining a test it is necessary to:

- [Assign tasks to channels](#)
- [Modify task settings](#)
- [Save test settings](#)

All test definition options are available from the **TestSetup** tab and are discussed in the following sections. This chapter provides an introduction to the Nomad Test Setup interface. For instructions on configuring specific types of tests, see [Chapter 9 – Voice Quality Configuration Options](#) and [Chapter 10 – Call Performance Configuration Options](#).



Figure 5-1 - Test Setup Tab

5.1 Assigning Tasks to Channels

Three different methods are available for assigning a new task to a channel:

1. Drag and drop any **Voice Quality Task** or **Call Performance Task** onto an available **Test Channel**.
2. Right-click on an individual channel and select **Add Task**. Then select the type of task to add from the sub-menu.
3. Right-click on a task name and select the channel(s) to apply to.

Repeat the selected process for all channels to be active during testing.

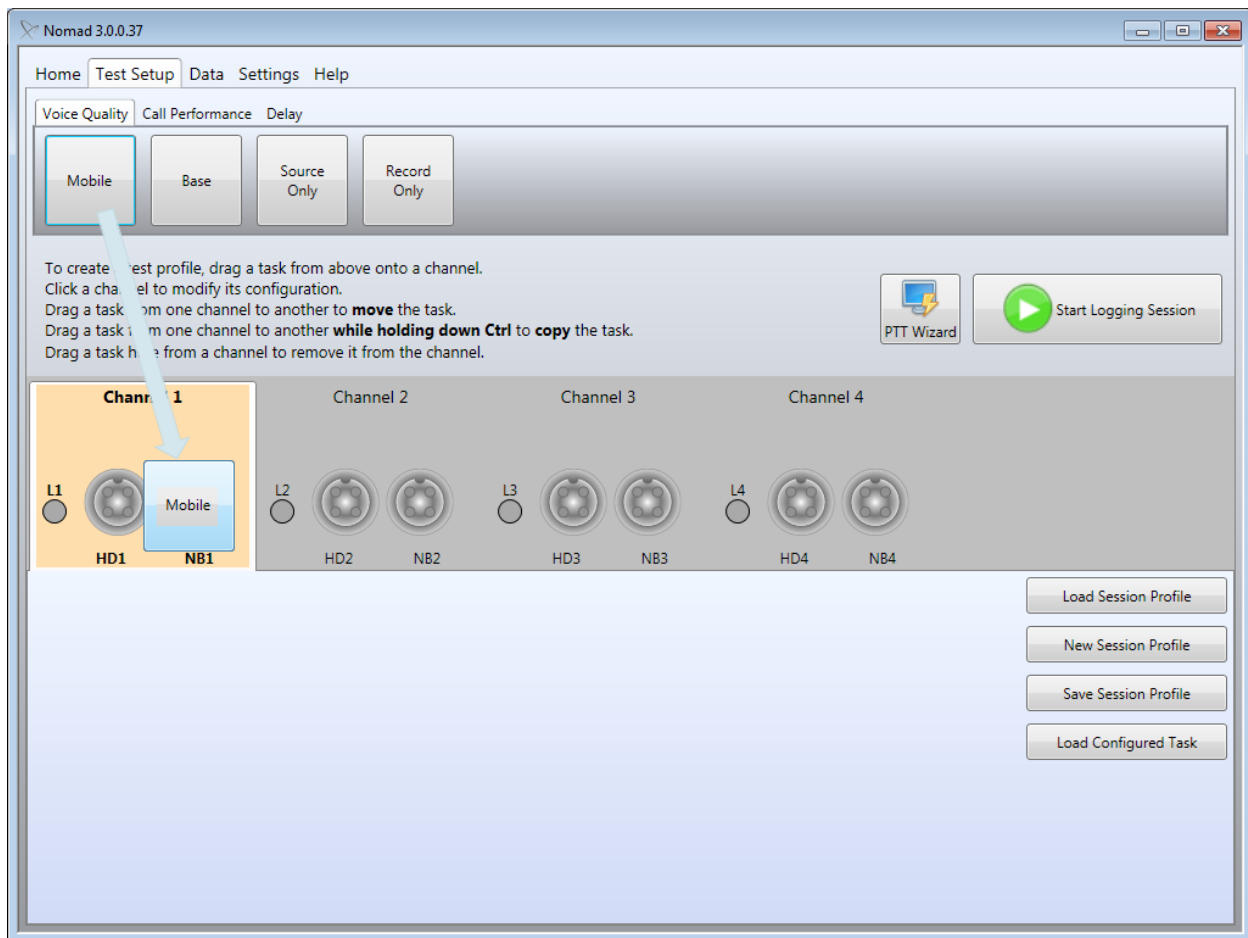


Figure 5-2 - Dragging a Task to a Test Channel

The task types available for selection are arranged on three different tabs:

- Voice Quality
- Call Performance
- Delay

Once a task has been assigned to each desired channel, continue to [Section 5.2](#) to modify the task settings.

5.1.1 Voice Quality Tasks

The following voice quality task types are available for selection:

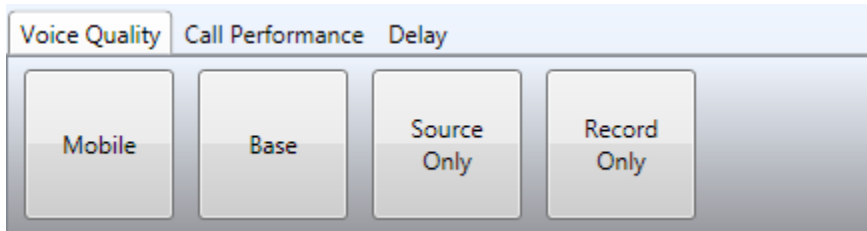


Figure 5-3 - Voice Quality Task Types

- Mobile
 - The test device on a **Mobile** channel serves as the downlink device in the mobile communication path. This option is used for:
 - Standard bi-directional testing using the Audio Server. (See [Section 9.2](#))
 - One of the test handsets in a bi-directional Mobile-to-Mobile test scenario (the other handset will be set as a Base). (See [Section 9.3](#))
 - One of the test handsets in a bi-directional Remote Unit test scenario (the other handset will be set as a Base). (See [Section 9.4](#))
 - A mobile acting as the downlink device in a test using the Landline Module. (See [Section 9.5](#))
- Base
 - The test device on a Base channel serves as the uplink device in the mobile communication path. This option should be selected for:
 - One of the test handsets in a bi-directional Mobile-to-Mobile test scenario (the other handset will be set as a Mobile). (See [Section 9.3](#))
 - One of the test handsets in a bi-directional Remote Unit test scenario (the other handset will be set as a Mobile). (See [Section 9.4](#))
 - The uplink end of a Landline Module test. (See [Section 9.5](#))
- Source Only
 - Select this option to perform uplink testing only. With this setting, Nomad will send speech every ten seconds but will not record anything. This setting can be used to shorten the test cycle time in the event that only uplink data is required.
- Record Only
 - Select this option to perform downlink testing only. With this setting, Nomad will record speech every ten seconds but will not source speech. This setting can be used to shorten the test cycle time in the event that only downlink data is required.

5.1.2 Call Performance Tasks

The following call performance task types are available for selection:

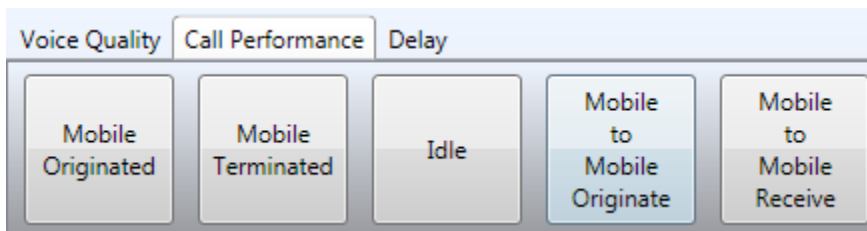


Figure 5-4 - Call Performance Task Types

- **Mobile Originated**
 - The mobile test device makes calls to the Call Server for call control testing. (See [Section 10.1](#))
- **Mobile Terminated**
 - The Call Server makes calls to the test mobile for call control testing. (See [Section 10.2](#))
- **Idle**
 - The test device makes no calls. This type of task only reports changes in signal strength and battery level.
- **Mobile to Mobile Originate**
 - This device makes calls to a receiving test device on another channel or on a remote unit. This option allows for call control testing without a call server. (See [Section 10.3](#))
- **Mobile to Mobile Receive**
 - This device receives calls from an originating test device on another channel or on a remote unit. This option allows for call control testing without a call server. (See [Section 10.3](#))

5.1.3 Delay Task

One task type is available on this tab.

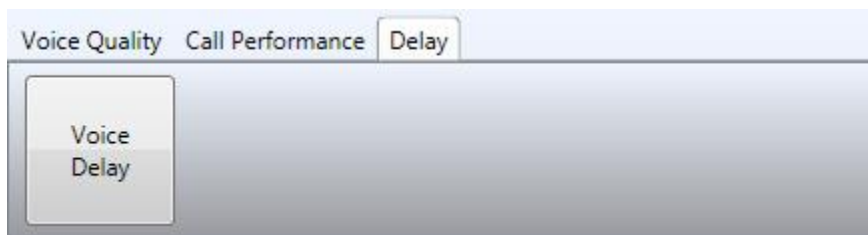


Figure 5-5 - Delay Task Type

- **Voice Delay**
 - This task allows for precise measurement of speech delay between two mobile devices connected to the same Spirent ME unit. The measurement includes delay introduced by both handsets and the time it takes to traverse the network. (See [Section 9.10](#))

5.2 Modifying Task Settings

Each assigned task must be configured with specific task settings. Click any available channel to modify its configuration. Different types of settings area available for different task types. Each Task Settings dialog is detailed in the sections below, including minor differences in content for different task types:

- [Device Info](#)
- [Session](#)
- [Channel Settings](#)
- [Call Campaign](#)
- [Email Campaign](#)
- [Auto-Level Assist](#)
- [Bluetooth Connection](#)
- [Reconnect All Bluetooth Channels](#)

5.2.1 Device Info

The fields in the **Device Info** dialog provide optional metadata for the session log file and help identify the test devices in session outputs. All fields in this dialog are optional:

- **Make** – The test device manufacturer.
- **Model** – The test device model name.
- **Role** – The role this device plays in the current test (i.e. “Reference”, “DUT”, etc.).
- **Hardware Identifier** – The device’s serial number (i.e. “ESN”, “IMEI”, etc.).
- **Adapter** – If an adapter was needed to interface to Nomad, note the model used here.

Channel 1 -> Mobile -> Device Info

Help

These fields provide optional metadata for the session log file and help identify the test devices in session outputs. All fields in this dialog are optional.

- **Make**
The test device manufacturer.
- **Model**
The test device model name.
- **Role**
The role this device plays in the current test (i.e. "Reference", "DUT", etc.).
- **Hardware Identifier**
The device's serial number (i.e. "ESN", "IMEI", etc.).
- **Adapter**
If an adapter was needed to interface to Nomad, note the model used here.

Make: Make 01

Model: Model 01

Role: Reference

Hardware Identifier:

Adapter:

Cancel << Previous Next >> OK

Figure 5-6 - Device Info Dialog

5.2.2 Session

The fields in the **Session** dialog specify connection settings for a **Voice Quality Task**. This dialog is not used for **Call Performance Tasks**. Some settings available in this dialog depend on the type of **Voice Quality Task** to be performed:

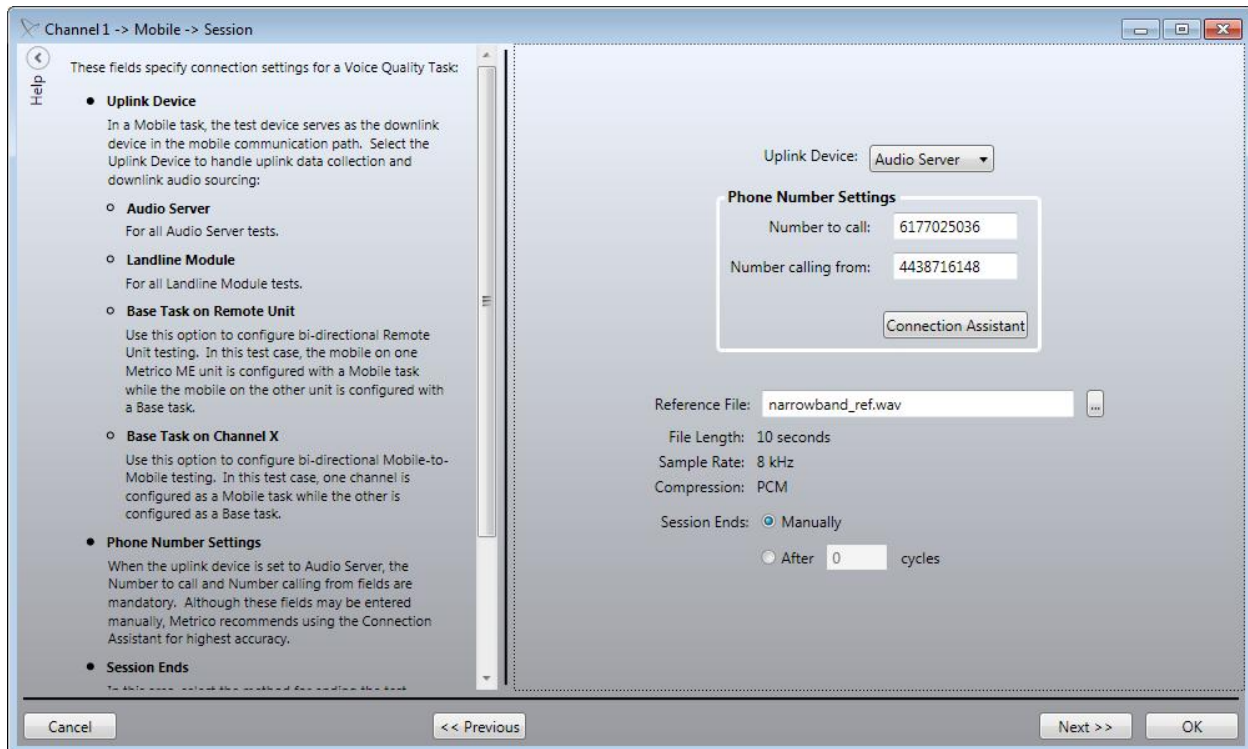


Figure 5-7 - Session Dialog

- **Device Selection Area** – Any Nomad **Voice Quality Task** is dependent on the transmission of speech between two communication nodes. In each task type, one node will be the mobile device connected to the Spirent ME hardware unit. The other end of the communication path may be selected for the task at hand:
 - **Uplink Device** – In a **Mobile** task, the test device serves as the downlink device in the mobile communication path. Select the **Uplink Device** to handle uplink data collection and downlink audio sourcing:
 - **Audio Server** – For all Audio Server tests.
 - **Landline Module** – For all Landline Module tests.
 - **Base Task on Remote Unit** – Use this option to configure bi-directional Remote Unit testing. In this test case, the mobile on one Spirent ME unit is configured with a **Mobile** task while the mobile on the other unit is configured with a **Base** task.
 - **Base Task on Channel X** – Use this option to configure bi-directional Mobile-to-Mobile testing. In this test case, one channel is configured as a **Mobile** task while the other is configured as a **Base** task.
 - **Downlink Device** – In a **Base** task, the test device serves as the uplink device in the mobile communication path. Select the **Downlink Device** to handle downlink data collection and uplink audio sourcing.

- **Mobile Task on Remote Unit** – Use this option to configure bi-directional Remote Unit testing. In this test case, the mobile on one Spirent ME unit is configured with a **Mobile** task while the mobile on the other unit is configured with a **Base** task.
 - **Mobile Task on Channel X** – Use this option to configure bi-directional Mobile-to-Mobile testing. In this test case, one channel is configured as a **Mobile** task while the other is configured as a **Base** task.
- **Recording Device** – In a **Source Only** task, only uplink testing is performed for that channel. Select the **Recording Device** to capture uplink data from the test mobile.
 - **Record Only task on remote unit** – Use this option to configure uni-directional Remote Unit testing. In this test case, the mobile on one Spirent ME unit is configured with a **Source Only** task while the other is configured with a **Record Only** task.
 - **Record Only task on channel X** – Use this option to configure unidirectional Mobile-to-Mobile testing. In this test case, one channel is configured as a **Source Only** task while the other is configured as **Record Only**.
- **Sourcing Device** – In a **Record Only** task, only downlink testing is performed for that channel. Select the **Sourcing Device** to source speech to the test mobile.
 - **Source Only task on remote unit** – Use this option to configure uni-directional Remote Unit testing. In this test case, the mobile on one Spirent ME unit is configured with a **Source Only** task while the other is configured with a **Record Only** task.
 - **Source Only task on channel X** – Use this option to configure unidirectional mobile-to-mobile testing. In this test case, one channel is configured as a **Source Only** task while the other is configured as **Record Only**.
- **Phone Number Settings** – This area appears in the **Session** dialog only for **Mobile** tasks. When the uplink device is set to **Audio Server**, the **Number to call** and **Number calling from** fields are mandatory. Although these fields may be entered manually, Spirent recommends using the **Connection Assistant** for highest accuracy. To use the **Connection Assistant**:
 - Click the **Connection Assistant** button to start the utility.
 - Click the **Edit Audio Server Settings** button. In the **Edit Audio Server Settings** dialog, select the **Audio Server Name** and enter the **Username** and **Password**. Click **OK** to accept the changes.

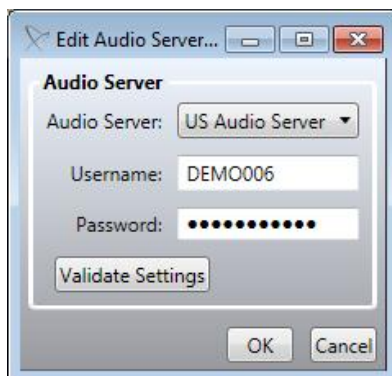


Figure 5-8 – Edit Audio Server Settings Dialog

- Dial the Audio Server using the handset to be connected to this channel. The handset does not need to be connected at this time.
- All active calls to the Audio Server will be represented in the **Connection Assistant** drop-down window using the **{4 Digit DNIS}-{10 Digit ANI}** convention:
 - **{4 Digit DNIS}** – The last four digits of the Audio Server phone number called by the mobile.
 - **{10 Digit ANI}** – The phone number of the mobile being tested.
- If the test handset does not appear in the list, use the **Refresh** button to update. It may take up to one minute for the handset to appear.
- Use the drop-down to select the correct number combination from the list.
- Click **OK**.



Figure 5-9 - Connection Assistant

- The **Number to call** and **Number calling from** fields will be populated based on your selection, removing the risk of manually entering this information incorrectly.
- **Note:** Spirent strongly recommends that international users outside of North America use the Connection Assistant to ensure that phone numbers are entered in the correct format.

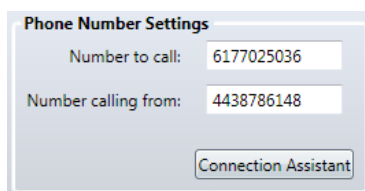


Figure 5-10 – Phone Number Settings Populated by the Connection Assistant

- **Reference file**

- This setting controls the reference file to be used for this voice quality task. This is an advanced setting which, when changed from the default value, will not work with

any of Spirent's default call servers, only when a corresponding 'base' task has been setup up on a second Nomad unit.

- **Session Ends** – In this area, select the method for ending the test session:
 - **Manually** – The user ends the test session by pressing the **Stop** button.
 - **After X Cycles** – The session ends after the system has run through X sourcing and recording cycles.

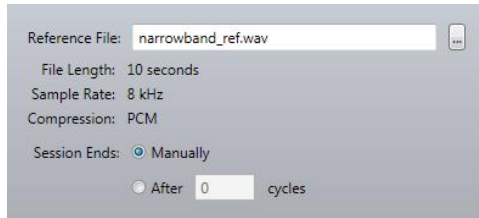


Figure 5-11 – Reference file Settings

5.2.3 Channel Settings

The fields in the Channel Settings dialog specify connection settings for a **Voice Quality Task**. This dialog is not used for **Call Performance Tasks**.

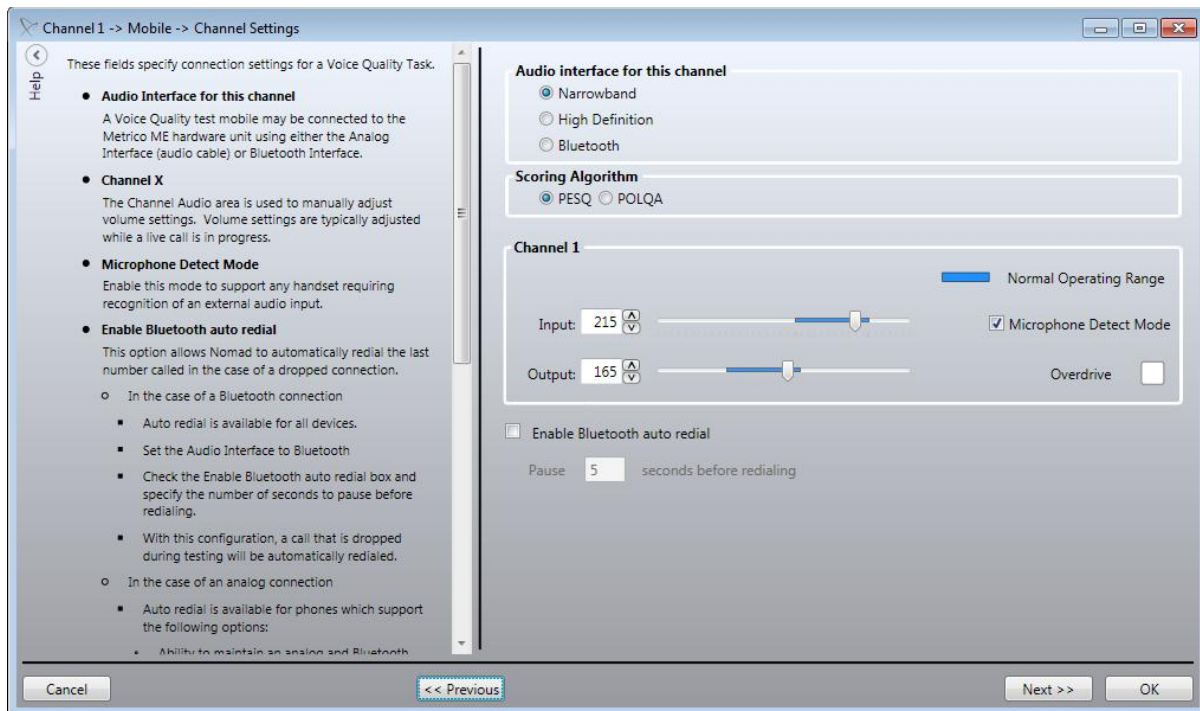


Figure 5-12 - Channel Settings Dialog

- **Audio interface for this channel** – A Voice Quality test mobile may be connected to the
 - Spirent ME hardware unit using either the **Analog Interface** (audio cable) or **Bluetooth Interface** (see [Section 5.2.7](#) for Bluetooth connection instructions)
 - Spirent HD ME hardware unit using either **Narrowband** (audio cable on the NBx interface), **High Definition** (audio cable on the HDx interface) or **Bluetooth Interface** (see [Section 5.2.7](#) for Bluetooth connection instructions). Spirent HD ME

hardware, for non-Bluetooth tests, has the ability to run tests with different sampling rates per channel pairs. The channel pairs are 1&2 and 3&4. Thus, if channel 1 is set to **Narrowband**, channel 2 cannot be set to **High Definition**.

- **Scoring Algorithm** – the MOS scoring algorithm used to score audio. When the Audio interface is set to **High Definition**, Channels 1 and 2 must be set to the same scoring algorithm, and channels 3 and 4 must be set to the same scoring algorithm. Depending on the licensing and hardware combination, the following scoring/audio interface combinations are possible:
 - **PESQ Scoring Algorithm**
 - For Nomad ME: The Narrowband, Wideband and Bluetooth options are available.
 - For Nomad HD ME: The Narrowband option is available through the NBx port and over the air through the Bluetooth interface.
 - **POLQA Scoring algorithm**
 - For Nomad ME: The Narrowband and Wideband options are available.
 - For Nomad HD ME: The Narrowband option is available through the NBx port, the High Definition option is available through the HDx port and over the air through the Bluetooth interface.
- **Channel X** – The Channel Audio area is used to manually adjust volume settings. If the **Input Level** (downlink volume) and **Output Level** (uplink volume) are known for the device on this test channel, use the sliders to set those values here. Otherwise, see [Section 5.2.5](#) to automatically optimize volume settings prior to testing or [Section 7.2](#) to manually adjust volume settings during testing.
- **Microphone Detect Mode** – Enable this mode to support any handset requiring recognition of an external audio input.
- **Enable Bluetooth auto redial** – This option allows Nomad to automatically redial the last number called in the case of a dropped connection.
 - In the case of a Bluetooth connection:
 - Auto redial is available for all devices.
 - Set the **Audio Interface** to **Bluetooth**.
 - Check the **Enable Bluetooth audio redial** box and specify the number of seconds to pause before redialing.
 - With this configuration, a call that is dropped during testing will be automatically redialed.
 - In the case of an analog connection:
 - Auto redial is available for phones which support the following options:
 - Ability to maintain an analog and Bluetooth connection simultaneously.
 - Ability to transfer from a Bluetooth connection to an analog connection.
 - Ability for the Bluetooth connection to be re-established while the phone is on the call.
 - To utilize auto redial with a qualified device:
 - Connect the test handset to the Spirent ME hardware using Bluetooth (see [Section 5.2.7](#) for Bluetooth connection instructions)
 - Next, attach the test handset to the same channel using an analog connection.
 - Verify that the Bluetooth connection is still active.
 - Set the **Audio interface for this channel** as **Analog**.
 - Check the **Enable Bluetooth auto redial** option.

- Specify the number of seconds to **Pause before redialing**.
- With this configuration, a call that is dropped during testing will be redialed using the Bluetooth connection. After three cycles of silence, Nomad will then issue a command to transfer the audio from the Bluetooth to the analog connection.

5.2.4 Call Campaign

The fields in the **Call Campaign** dialog are used to specify duration and sequencing of a **Call Performance Task**. This dialog is not used for **Voice Quality Tasks**. All of the fields in this dialog must be completed.

Figure 5-13 - Call Campaign Dialog (Mobile Originated Task)

- Enter the **Phone Number Settings**.
 - For a **Mobile Originated** call campaign, enter the **Number to call** as the call server number provided by Spirent Communications to be dialed by the mobile, as well as the **Number calling from**.
 - For a **Mobile Terminated** call campaign, enter the **Number to dial** as the mobile phone number to be dialed by the Call Server.
 - For a **Mobile to Mobile Originate** task, use the drop-down to select the location of the **Receiving Device**. Enter the **Number to dial** for the receiving device.
 - For a **Mobile to Mobile Receive** task, use the drop-down to select the location of the **Calling Device**. Enter the **Calling number** of the originating device.
- Select the **Call Initiation Mode**. The Call Initiation Mode is applicable only when the same **Call Performance Task** is applied to multiple channels during a test. This option does not apply to a Mobile-to-Mobile Call Performance task.
 - **Synchronous Testing** – Calls start simultaneously on all devices regardless of call outcomes. For example, if one device drops a call, it will remain idle until the next time all mobiles are scheduled to start a new call. Note that **Synchronous Testing** may not be maintained for Mobile Terminated call campaigns.
 - **Asynchronous Testing** – Each device follows its own call sequence without regard to other device progress. In this mode, if one device drops a call, it will wait for the specified time and then start a new call, even as the other devices continue their first call.

- Specify the values for the task parameters. In the Mobile-to-Mobile case, these parameters will be set in the **Mobile-to-Mobile Originate** task.
 - **Access Timeout** – A call attempt that has not connected within this amount of time will be classified as an Access Timeout event.
 - **Duration** – The length of each call in the test sequence.
 - In a **Synchronous** campaign, this refers to the total attempt duration including access time and connected time.
 - In an **Asynchronous** campaign, this refers to the connected time only.
 - **Wait Time** – The amount of idle time between the end of one call in the sequence and the start of the next call.
 - **Attempts** – The number of calls to attempt in this task sequence.

5.2.5 Auto-Level Assist

The **Auto-Level Assist Wizard** provides an automatic method for determining optimal downlink and uplink volume for **Voice Quality Tasks** running on mobiles connected via the analog audio interface. The **Auto-Level Assist Wizard** has no bearing on **Call Performance Tasks** or on **Voice Quality Tasks** using a Bluetooth connection. The Auto-Level Assist procedure bypasses the need for manual adjustments in determining the optimal input level (downlink volume) and output level (uplink volume) for testing.

Before beginning the Auto-Level Assist process, please take note of these guidelines recommended by and followed by Spirent staff:

- Confirm that the test mobile is in a good coverage area.
- Confirm the presence of a high-speed internet connection required for auto-calibration with the **Auto-Level Assist Wizard**.

To run the **Auto-Level Assist Wizard**:

- From the **TestSetup** tab, select the **Auto Level Assist** button found under any Voice Quality task using the Analog Audio Interface (see [Section 5.2.3](#) to select the **Channel Audio Interface**).
- Confirm that the Audio Server settings are correct using the **Validate Settings** button. It is not possible to continue beyond this screen until the Audio Server settings have been validated.

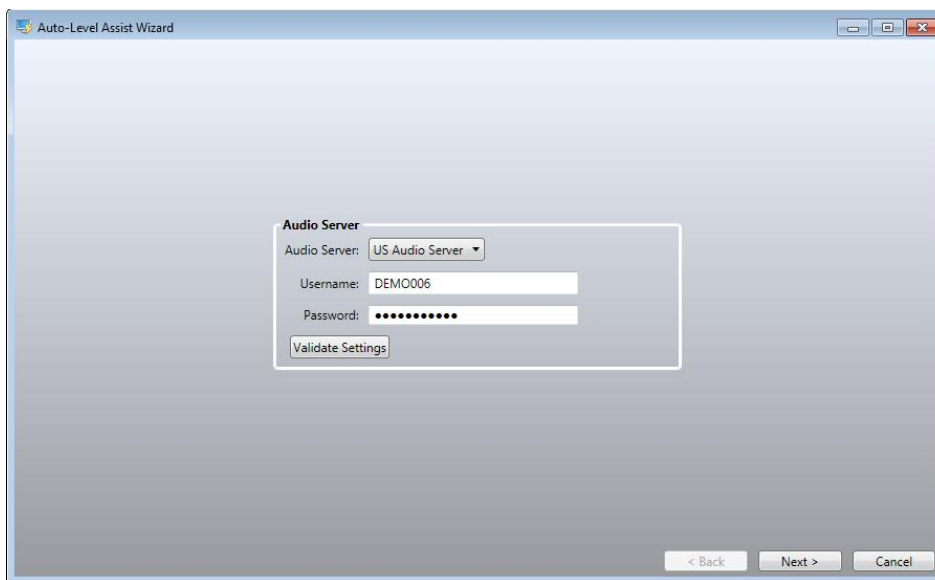


Figure 5-14 - Auto-Level Assist Audio Server Validation

- Click **Next** to continue.
- Confirm that the **HandsetPhone #** and **Audio Server #** are correct for all channels to be optimized. Use the **Connection Assistant** for the highest accuracy when entering the phone numbers (see [Section 5.2.2](#) for more information on the **Connection Assistant**).

- **Note:** Spirent strongly recommends that international users outside of North America use the **Connection Assistant** to ensure that phone numbers are entered in the correct format.
- Click **Next** to continue.

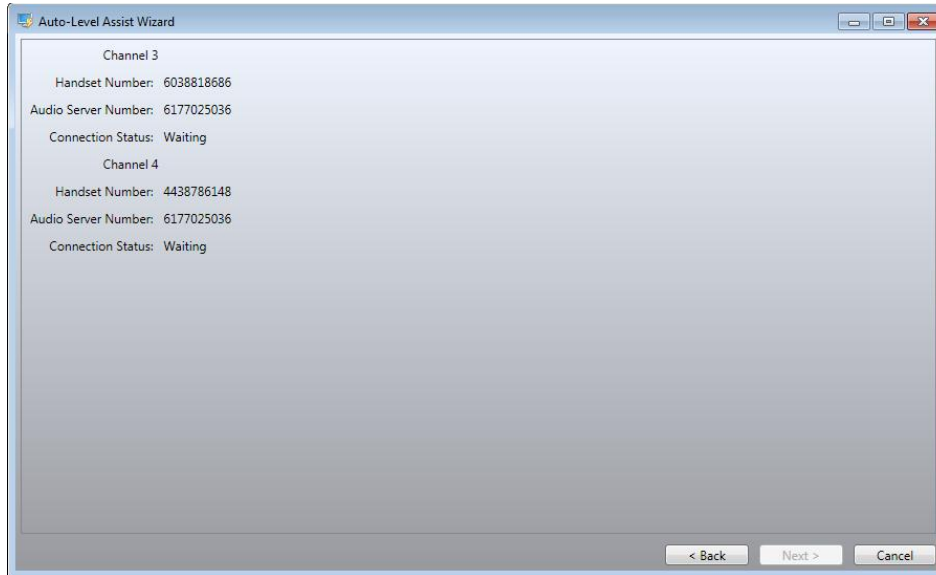


Figure 5-15 - Auto-Level Assist Phone Number Validation

- You will be asked whether you wish to **check for uplink connectivity** to verify communication with the server. Click **Yes** to verify.
- Place the calls on the mobile handsets and connect the handsets to the Spirent ME hardware using the audio cables. See [Section 6.3](#) for instructions on placing calls.
- Click **Next** to continue.

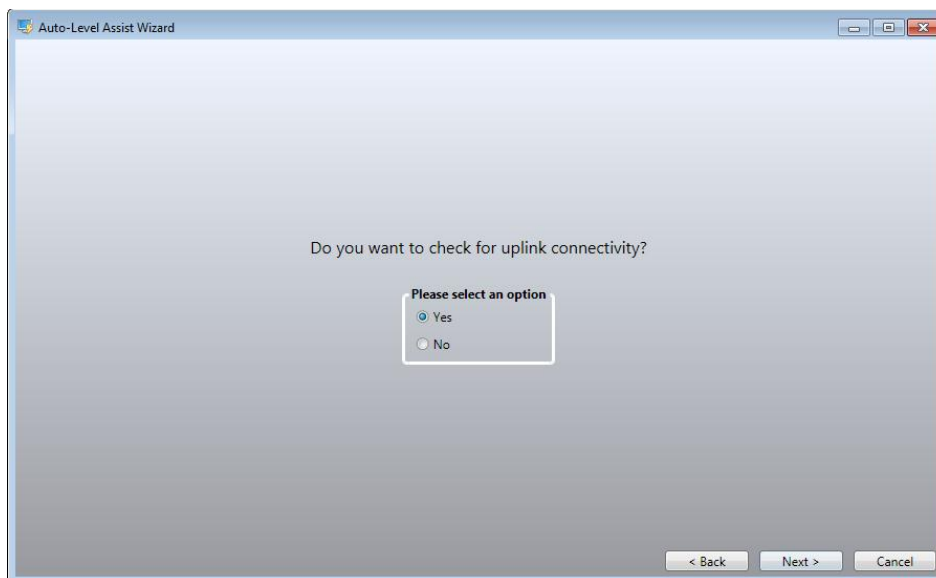


Figure 5-16 - Auto-Level Assist Prompt to Check for Uplink

- The system will make three attempts to contact the Audio Server. When connectivity is verified, the level assist automation will begin.

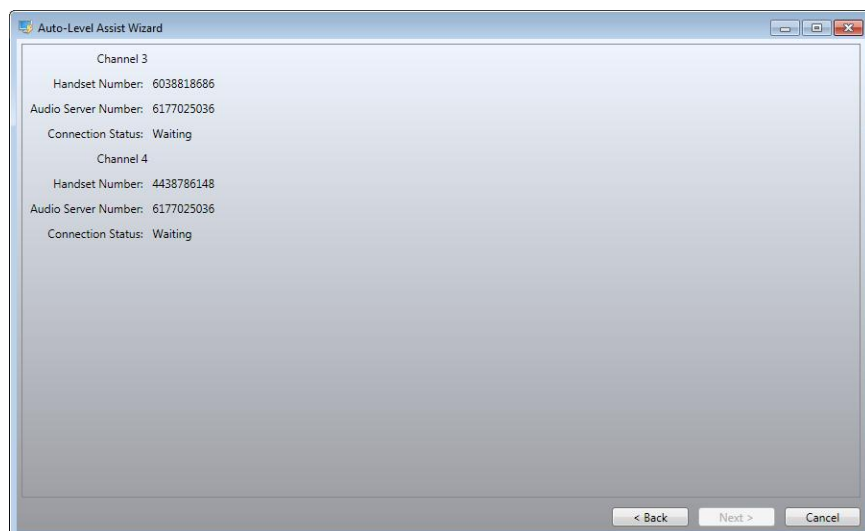


Figure 5-17 - Auto-Level Assist Audio Server Connectivity Verification

- The auto-calibration process will run for several minutes displaying MOS progress as volume is adjusted. Slightly different algorithms are used to determine optimal downlink and uplink volume:
 - The downlink algorithm closely follows Spirent's recommendation for manual volume adjustment (see [Section 7.1.1.2](#)). The algorithm increases the input level until the Overdrive condition is detected. From there, the input level is decreased for several cycles. The level producing the best MOS result from the ramp-down procedure is stored.
 - The uplink algorithm uses a form of binary search logic. The algorithm finds the lowest output volume producing a valid uplink score. The volume is then adjusted to the highest nominal operating level. The algorithm then uses combinations of average level to zero in on the level producing the best MOS result.

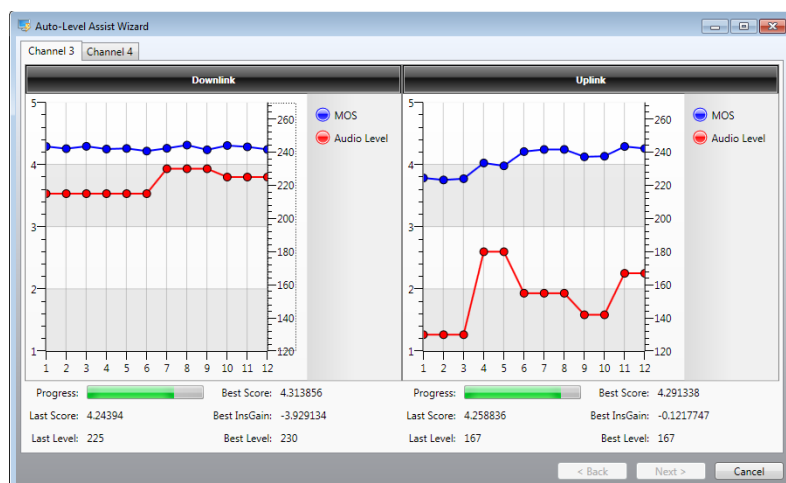


Figure 5-18 - Auto-Level Assist Automation

- After the **Auto-Level Assist Wizard** has run its course, the **Results Review** dialog will appear. Examine the downlink and uplink results for each channel. Select whether to use the saved level setting or the Level Assist recommendation.
- Click **Next** to store selections.

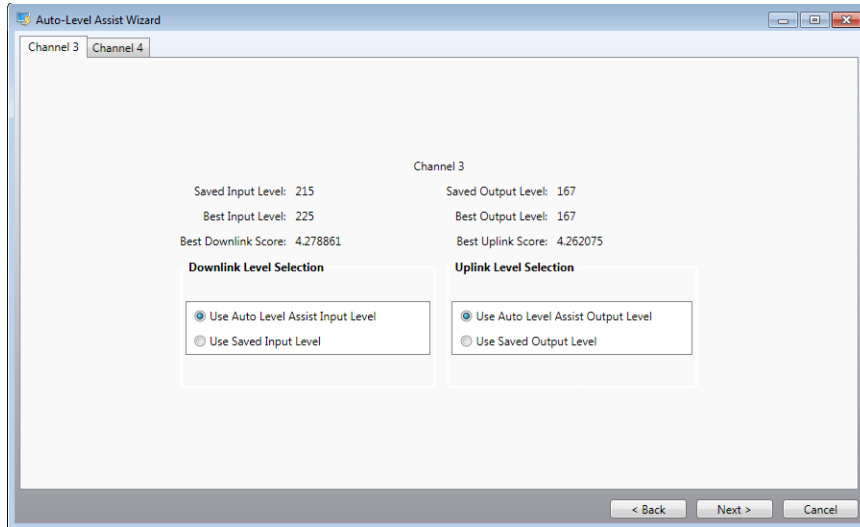


Figure 5-19 - Auto-Level Assist Results Review

The Auto-Level Assist process should be repeated if, during testing, the input and output levels do not provide:

- Maximum MOS values and/or
- Downlink and uplink insertion gain values corresponding to Spirent's recommendations (downlink gain close to 0, uplink gain between -12 and -3 dB)

If the Auto-Level Assist process is unable to provide appropriate results, the input and output volume settings should be manually overridden during testing using the procedure described in [Section 7.2.1.2](#).

5.2.6 Email Campaign

An Email Campaign may be launched during a **Voice Quality** or **Call Performance** task to test Multi-RAB performance. An Email Campaign tests whether email sent to the phone during a call disrupts performance as compared to phones not receiving email. An email campaign may be launched from the **Email Campaign** dialog.

Channel 1 -> Mobile -> Email Campaign

An Email Campaign may be launched during a Voice Quality or Call Performance task to test Multi-RAB performance. An Email Campaign tests whether email sent to the phone during a call disrupts performance as compared to phones not receiving email.

- **Initiate email campaign when logging starts**
Select to enable an email campaign.
- **Recipient email address (To:)**
Email address accessible on the test mobile.
- Specify the duration of the email campaign by completing:
 - # of emails to send
 - Interval between emails
- If desired, Generate Test Email to be sent to the mobile device.

☐ Initiate email campaign when logging starts

Recipient email address (To:)

of emails to send: 0

Interval between emails: 0 seconds

Estimated duration: 00:00:00 (hh:mm:ss)

Generate Test Email

Cancel << Previous Next >> OK

Figure 5-20 - Email Campaign Dialog

- If an email campaign is desired during testing, select the **Initiate email campaign when logging starts** option.
- Enter an email address accessible on the test mobile in the **Recipient email address (To:)** field.
- Enter the **# of emails to send** to the mobile.
- Enter the **Interval between emails** in seconds.
- If desired, **Generate Test Email** to be sent to the mobile device.

Note: In the event that Nomad becomes inaccessible during an Email Campaign (i.e. due to PC crash, etc.), it is possible to stop email messages from being sent to the handset(s). Simply reply to any message generated by the Email Campaign to stop unwanted messages from being sent to the phone.

5.2.7 Bluetooth Connection

Use the **Bluetooth Connection** screen to perform pairing of the test device with the Spirent ME hardware unit. The **Bluetooth Connection** dialog will be available for any **Voice Quality Task** with the **Audio Interface** set to **Bluetooth**. The **Bluetooth Connection** dialog will be available for all **Call Performance Tasks**.

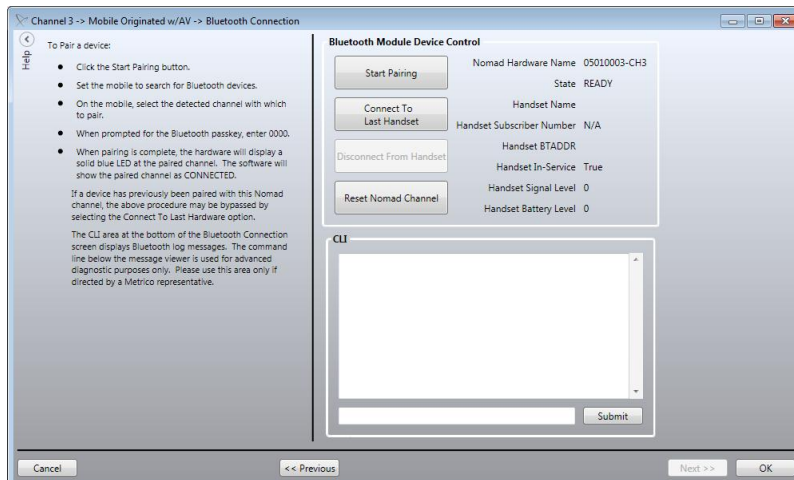


Figure 5-21 - Bluetooth Connection Dialog

To pair a device:

- Click the **Start Pairing** button. The corresponding LED will flash blue on the front of the hardware unit.
- Set the mobile to search for Bluetooth devices. This procedure varies among devices, but the option is generally found under the **Settings** or similar menu.
- The mobile may detect multiple Nomad channels, but will only be pairable with the channel that is in pairing mode. Select the appropriate channel based on the **Nomad Hardware Name** field.
- When prompted for the Bluetooth passkey, enter **0000**.
- When pairing is complete, the hardware will display a solid blue LED at the paired channel. The software will show the paired channel as **CONNECTED**.
 - **Note:** The connection process must be handled manually for some handsets. If the blue light does not appear on the Spirent ME hardware unit and the software does not show the **CONNECTED** state, the phone must be connected manually. This is typically accomplished through the phone's Bluetooth menu system.

Note that if a device has previously been paired with this Nomad channel, the above procedure may be bypassed by selecting the **Connect To Last Handset** option. Selecting this option will automatically connect the channel to the last device to which it was paired. To reconnect all previously connected Bluetooth channels to the last paired handset, used the **ReconnectAll Bluetooth Channels** button found on the **Test Setup** tab.

The **CLI** area at the bottom of the **Bluetooth Connection** screen displays Bluetooth log messages. The command line below the message viewer is used for advanced diagnostic purposes only. Please use this area only if directed by a Spirent representative.

5.2.8 ReconnectAll Bluetooth Channels

The **ReconnectAll Bluetooth Channels** button will be available for voice quality tasks with the **Audio Interface** set to Bluetooth and for all **Call Performance** tasks. Click this button to reconnect all previously connected Bluetooth channels to the last paired handset.

5.3 Saving Test Settings

Once tasks have been assigned to all test channels and settings for all tasks have been configured to meet testing requirements, it may be desirable to save these settings for future use. The two options available for saving task settings are:

- [Configured Tasks](#)
- [Session Profiles](#)

All options for working with Configured Tasks and Session Profiles are available using the buttons in the lower right-hand corner of the **TestSetup** screen.

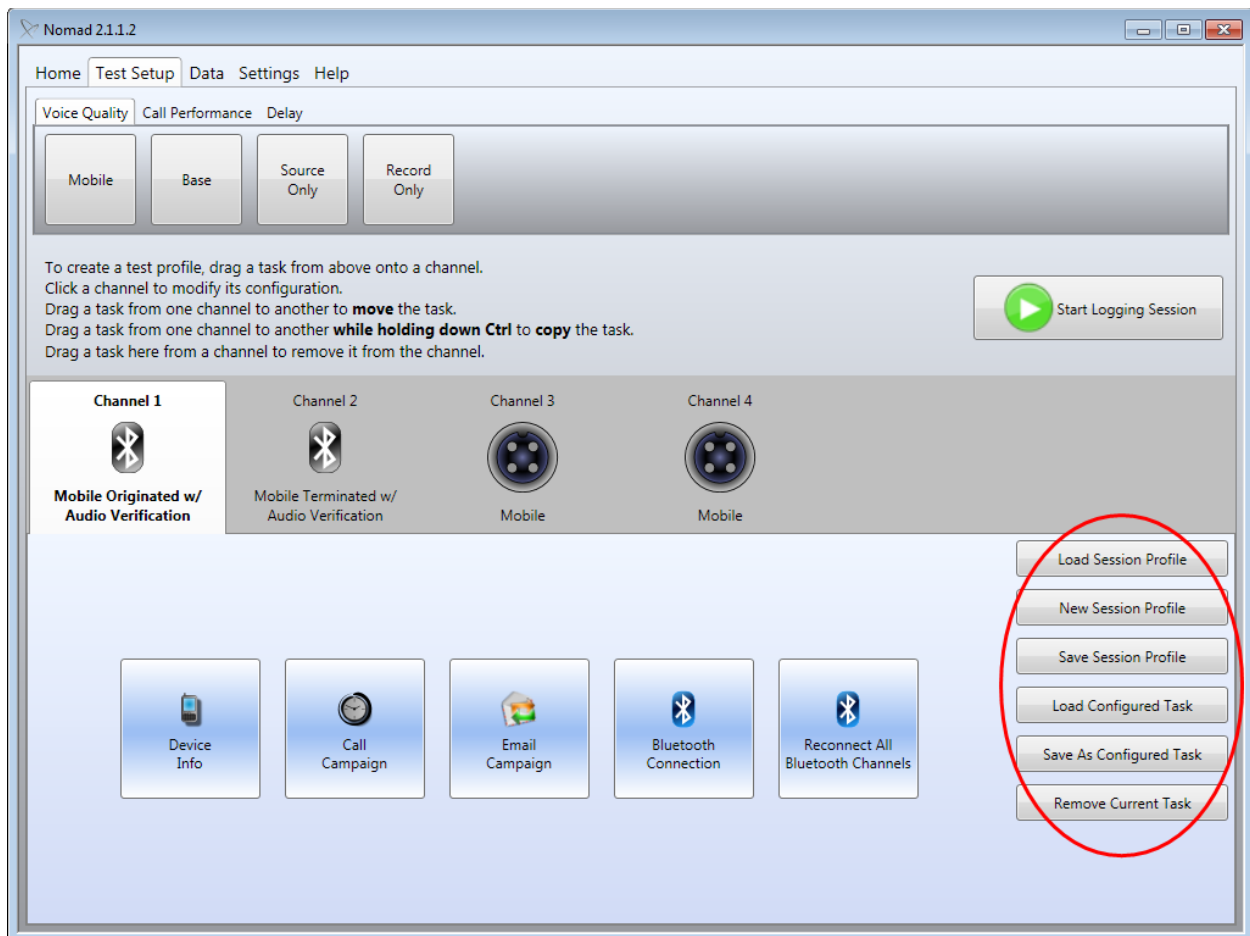


Figure 5-22 - Locating the Nomad File Options

5.3.1 Working with Configured Tasks

A **Configured Task** saves all of the settings for the currently selected task. A Configured Task may then be applied to any test channel in the current or future tests. This option is useful for replicating a single task across multiple test channels.

To save a **Configured Task**:

- Configure all task settings as desired.
- Select the **Save As Configured Task** option on the **Test Setup** tab.
- **Name** the **Configured Task** and then **Save**.

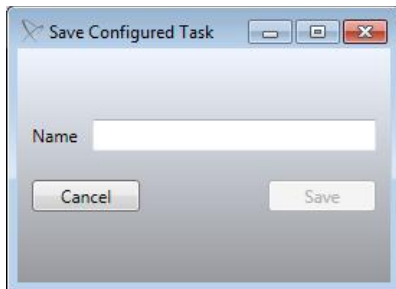


Figure 5-23 - Save Configured Task Dialog

To apply a **Configured Task** to a test channel:

- Click the **Load Configured Task** button on the **Test Setup** tab.
- Click to select any **Configured Task** shown.

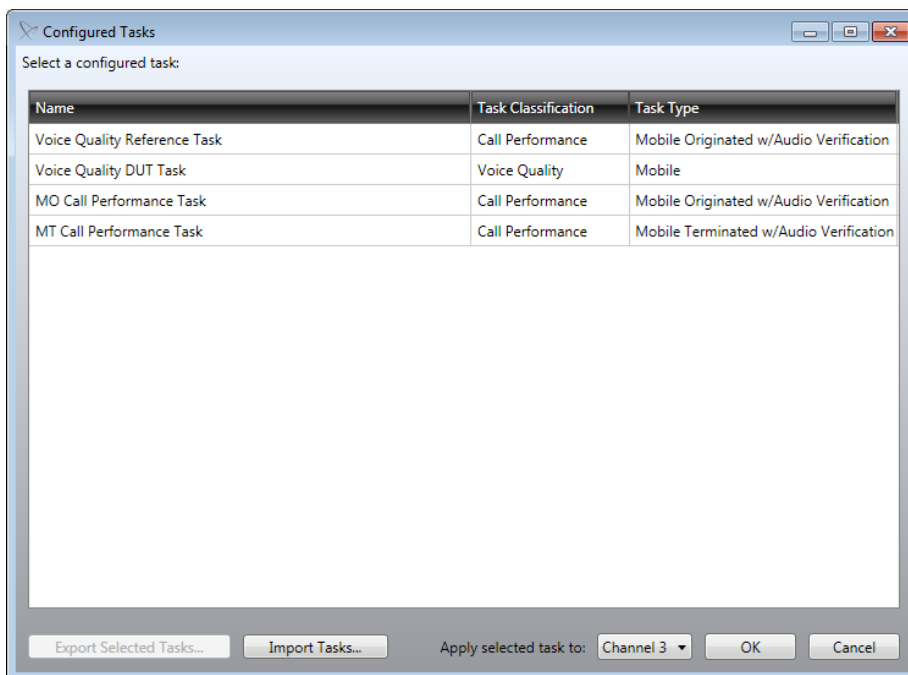


Figure 5-24 - Select a Task from the List

- Two methods are available to apply the task to any specific channel or **All Channels**:
 1. Use the **Apply selected task to:** drop-down at the bottom of the dialog. Then click **OK** to confirm the selection.
 2. Right-click on the selected task and select **Apply To** and the channel number. The **Configured Tasks** dialog will close automatically.

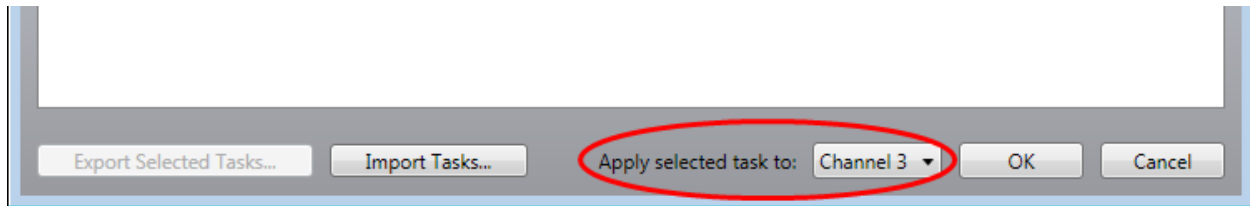


Figure 5-25 - Applying the Selected Task

A **Configured Task** may be exported as an XML file to share with other users. To export a **Configured Task**, click the **Export Selected Tasks** button in the **Configured Tasks** dialog. The saved XML may be imported into Nomad using the **Import Tasks** button in the **Configured Tasks** dialog.

A task may be removed from a channel using the **Remove Current Task** button on the **Test Setup** tab.

5.3.2 Working with Profiles

A **Session Profile** defines the tasks and settings for all available test channels. Unlike a **Configured Task** which defines a task type and settings for an individual task, a **Session Profile** defines the task type and settings applied to each test channel.

To save a **Session Profile**:

- Configure all desired test channels with tasks and settings to meet testing requirements.
- Click the **Save Session Profile** button on the **Test Setup** tab.
- **Name** the **Session Profile**.
- Choose whether to include:
 - All global settings included in the Settings section
 - Channel metadata (make, model, etc.)
 - Number to dial and number dialing from

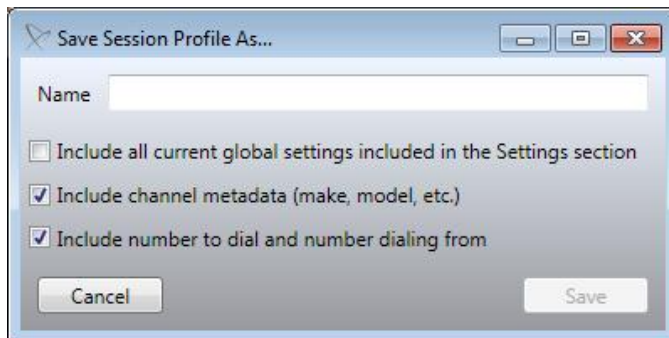


Figure 5-26 - Save Session Profile As Dialog

To assign tasks to channels by loading a **Session Profile**:

- Click the **Load Session Profile** button on the **Test Setup** tab.
- Select any **Saved Session Profile** shown.
- Choose whether to load the channel metadata and number to dial / number dialing from that was saved with the profile.

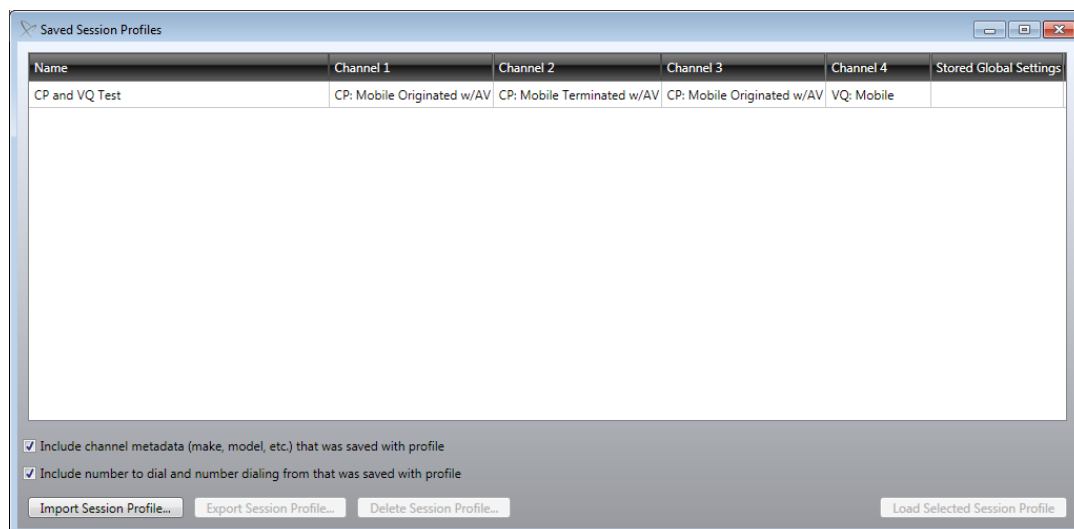


Figure 5-27 - Select a Saved Session Profile

- Click the **Load Selected Session Profile** button in the bottom right corner of the dialog.

Each test channel configured in the **Session Profile** will be populated on the **TestSetup** tab.

A **Session Profile** may be exported as an XML file in order to share with other users using the **Export Session Profile** button in the **Saved Session Profiles** dialog. The saved XML file may be imported into Nomad using the **Import Session Profile** button in the **Saved Session Profiles** dialog.

Remove the tasks from all channels to build a new **Session Profile** from scratch using the **New Session Profile** button.

6 Initiating a Test

Once a task has been assigned to each Nomad test channel and task settings have been configured, a test session may be initiated. To start a test:

- Click the **Start Logging Session**  button on the **Test Setup** tab.

The **Start Logging Session Wizard** will appear. The following sections describe each step in the Wizard.

6.1 Reviewing the Current Channel Configuration

On the first screen of the **Start Logging Session Wizard**:

- Confirm the **Audio Configuration** and **Email Campaign Configuration** settings for each test channel.
- If any changes are required, press **Cancel** to exit the Wizard and return to the **Test Setup** tab. Otherwise, click **Next** to proceed to the next screen.

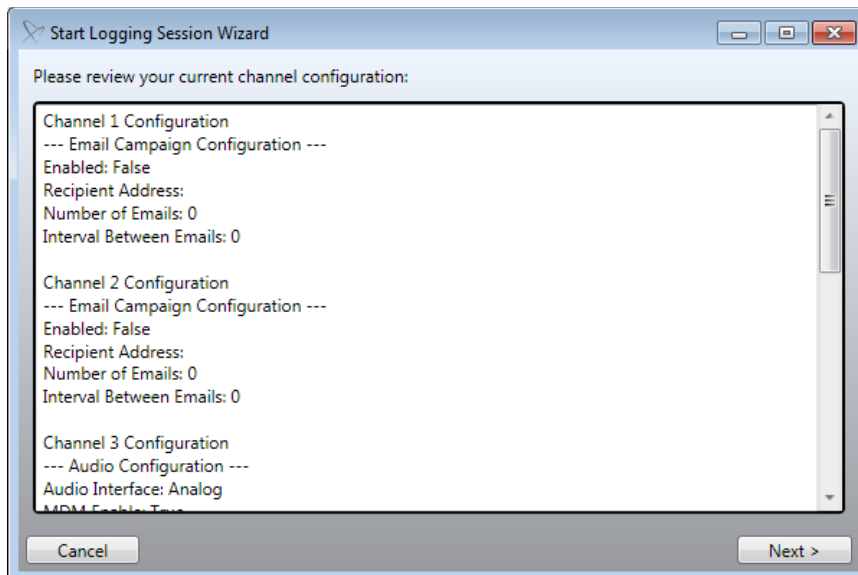


Figure 6-1 - Reviewing the Current Channel Configuration

6.2 Device Setup

If device pairing was not completed for any Bluetooth channel when task settings were modified, the pairing may be completed on the **Bluetooth Module Device Control** screen. This screen will not appear if all test devices use the Analog audio interface.

- The options on this screen are identical to those in the task settings **Bluetooth Connection** dialog. See [Section 5.2.7](#) for instructions on pairing each Bluetooth device with the Spirent ME hardware unit.
- Click **Next** when all Bluetooth devices have been paired.

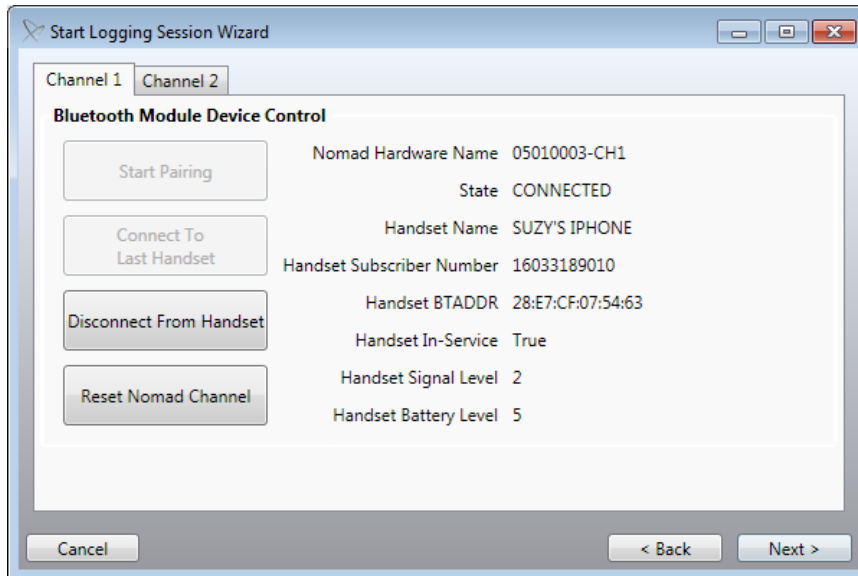


Figure 6-2 - Bluetooth Module Device Control

6.3 Placing Calls on Mobile Handsets

At the conclusion of the **Start Logging Wizard**, Nomad will automatically place test calls for:

- All devices running **Call Performance** tasks.
- Devices running Voice Quality tasks which are connected via Bluetooth and which have been configured for auto-dial on the **Settings** → **Voice Quality** tab (see [Section 4.4.3](#)).

All other calls must be manually placed to the Audio Server. To place each call:

- Dial the handset using the Audio Server phone numbers supplied with Nomad.
- Following the voice prompt, enter the **Access PIN** (if applicable).
- Verify from the voice prompt that the session has started.
- Connect the handset to the licensed channel audio cable (Channel 1, Channel 2, etc.) as appropriate.

6.4 Selecting the Log File Storage Location

To specify the log file storage location and other session information:

- In the **File Path** area use the **Browse** button to select a log file location and file name. This field is required.
- Complete the **User Name**, **Route/Location** and **Description** fields as desired. This information serves as optional metadata written to the session log file.
- Click **Next** to continue.

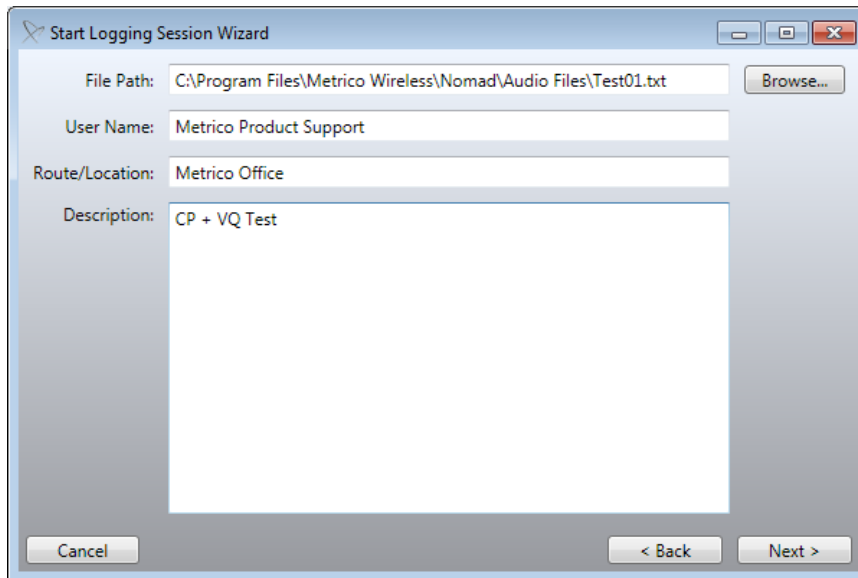


Figure 6-3 - Specifying the Log File Storage Location and Session Information

6.5 Time Synchronization

The successful use of the Nomad system is strictly dependent on consistent timing between the test laptop and the Audio or Call Server. Time synchronization is critical in the case of a **Voice Quality** or **Mobile Terminated Call Performance** campaign.

Nomad will automatically attempt to synchronize the system clock to atomic time, the standard used by both the Audio and Call Server. Nomad will first attempt synchronization using the **Source** method specified in the **GPS/Time** area of the **Settings** tab. If unavailable, Nomad will attempt synchronization using the other method.

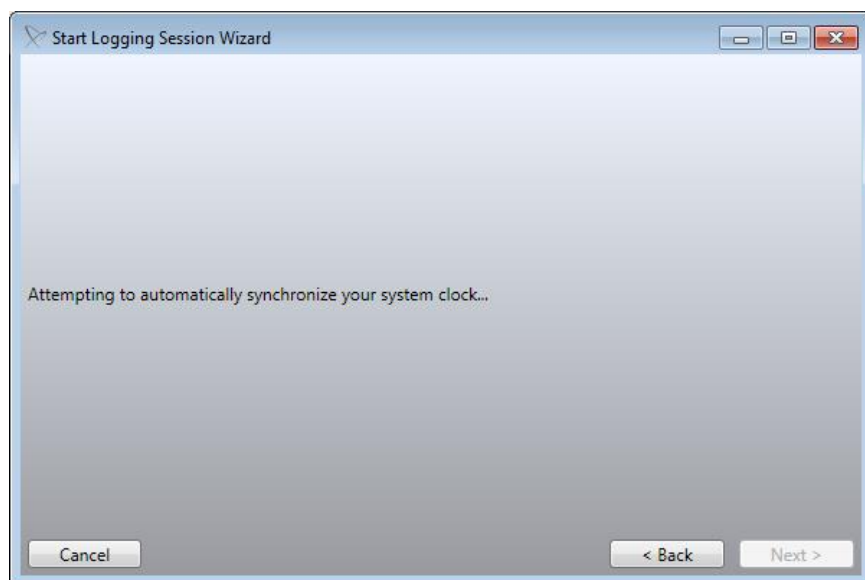


Figure 6-4 - Attempting to Synchronize Time

If neither GPS nor internet connectivity is available, synchronization will fail. Although the **Start Logging Session** button becomes available on the **Failed Synchronization** screen, Spirent recommends troubleshooting GPS and/or internet connectivity and then retrying. Running a logging session without verifying time synchronization is not recommended and may result in invalid data.

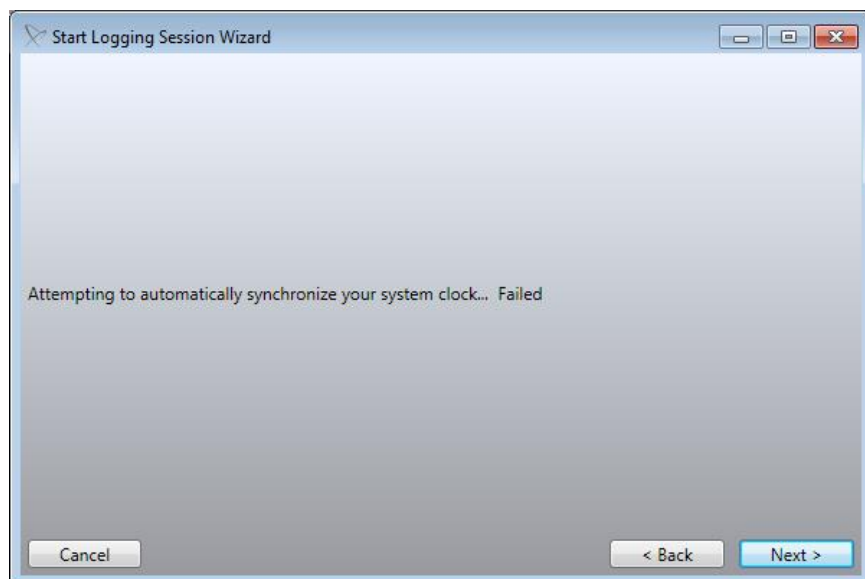


Figure 6-5 - Time Synchronization Failed

Once time synchronization is complete, the logging session will begin automatically.

7 Monitoring a Test in Progress

Topics of interest while a test is in progress include:

- [Nomad Test Window Orientation](#)
- [Manual Volume Adjustment \(Voice Quality Testing\)](#)
- [Event Logging and Event Detection \(Voice Quality Testing\)](#)
- [Interpreting MOS Results \(Voice Quality Testing\)](#)

7.1 Nomad Test Window Orientation

Figure 7-1 shows a Nomad test in progress including both voice quality and call performance tasks:

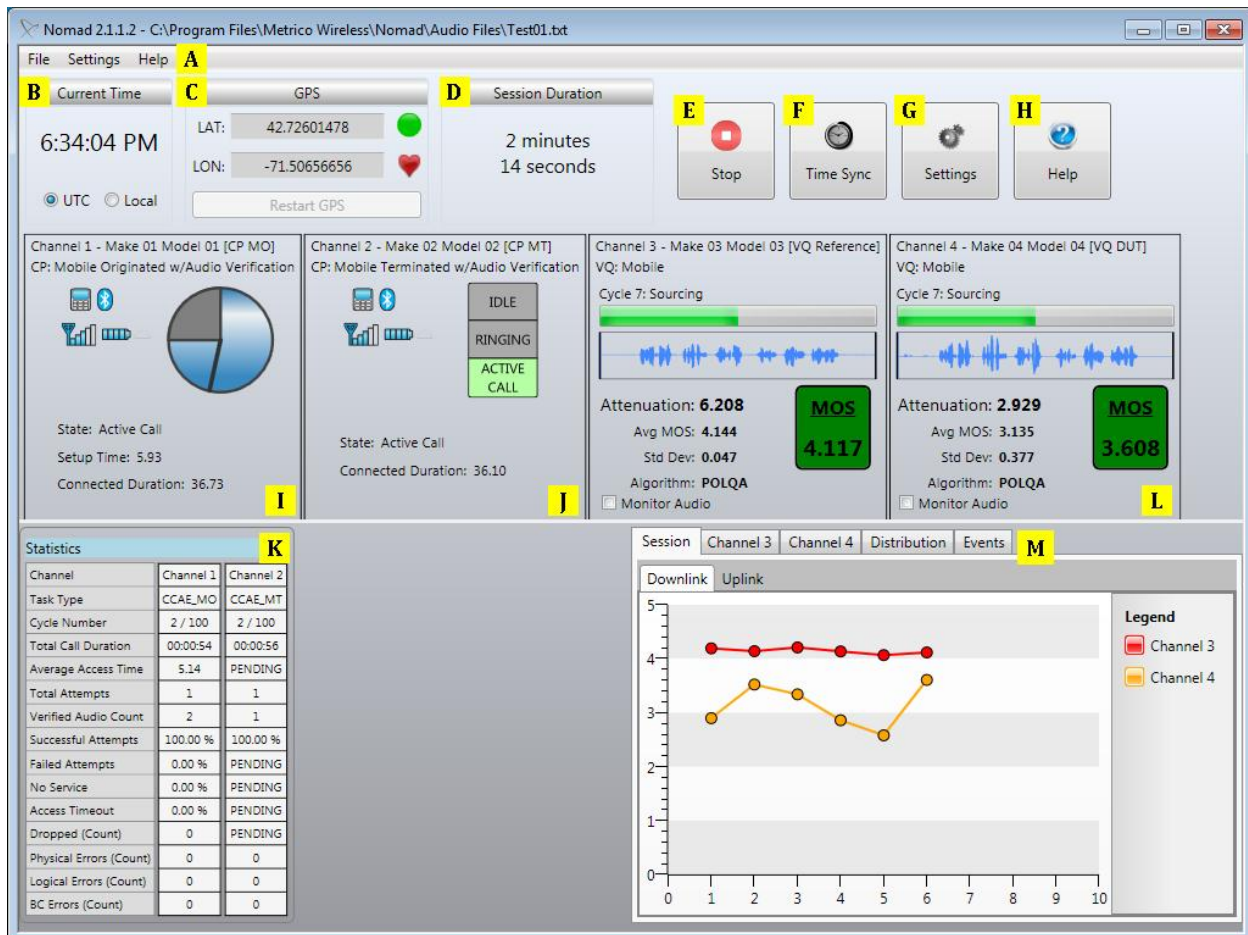


Figure 7-1 - Monitoring a Test in Progress

Key areas of interest in the Nomad test window include:

A. Menu Bar

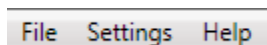


Figure 7-2 - Menu Bar

B. Current Time Indicator

- The radio button selected here is used to control the time display during testing.
 - Select **UTC** to display data collection time in UTC (Coordinated Universal Time), also known as GMT (Greenwich Mean Time).
 - Select **Local** to display data collection time according to the test laptop's local time.
- The time format selected here is for display purposes only. The **Output local time when generating reports** checkbox on the **Settings → General** tab controls the time format for output reports. If this option is left unchecked, time will be listed in UTC in Nomad output reports.

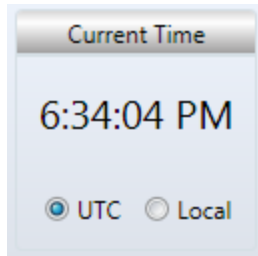




Figure 7-3 - Current Time Indicator

C. GPS Information

- If GPS is available, the current latitude and longitude are displayed.
- The GPS FIX status is given by the colored circle in this area. Hover over the circle for the status tooltip. The status is provided as **NO FIX**, **2-D**, **2-D DIFF**, **3-D** or **3-D DIFF**. **DIFF** status refers to a lock on differential GPS sensors, providing a slightly more accurate location reading than standard GPS.
- The **blinking heart**  indicates that Nomad is receiving messages from the GPS. The heart blinks each time a GPS message is received.
- The **yellow triangle**  indicates that an error has occurred. Click the **Restart GPS** button once to activate GPS (in some cases it may be necessary to click this button twice).

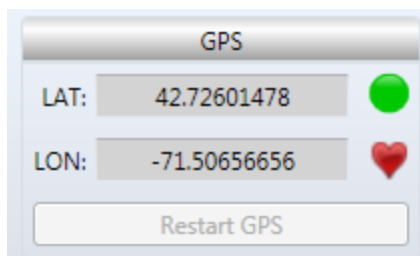


Figure 7-4 - GPS Information

D. Session Duration

- The elapsed time since the start of the session is displayed here.

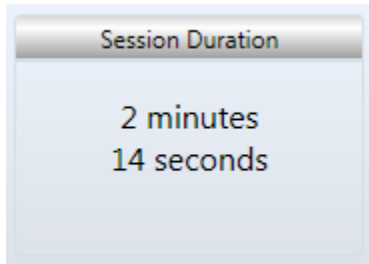


Figure 7-5 - Session Duration

E. Stop

- Use this button to manually end a test session.
- **Note:** Losing internet connectivity during a Mobile Terminated Call Performance campaign may cause the **Stop** button to cease working. In this case, wait for a call to come to the phone, answer the call and dial **9999**. This will manually stop the Call Server from repeatedly calling the phone through the scheduled end of the test.

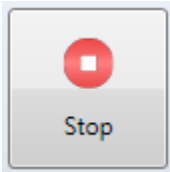


Figure 7-6 - Stop Button

F. Time Sync

- This dialog allows the user to manually synchronize the test laptop's clock with the Audio and/or Call Server.
- To manually synchronize time:
 - Select the **Time Sync** button during testing.
 - Select the **Time Synchronization Source**.
 - Click the **Sync Now** button.
- Check **Enable automatic time synchronization** to prevent time drift. Set the period between time synchronization updates in minutes. Spirent recommends setting this to 5 minutes for frequent updates. Note that time synchronization during testing has no impact on data collection or performance.



Figure 7-7 - Time Sync Button

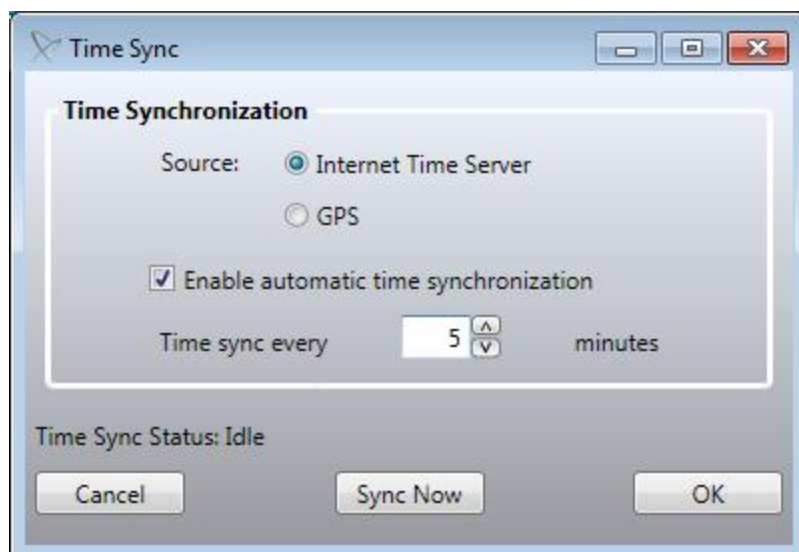


Figure 7-8 - Time Sync Dialog

G. Settings

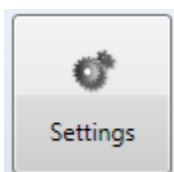


Figure 7-9 - Settings Button

- **Levels** – Use this tab to manually adjust uplink and downlink volume settings for each channel. See [Section 7.2](#) for details on manual volume adjustment.

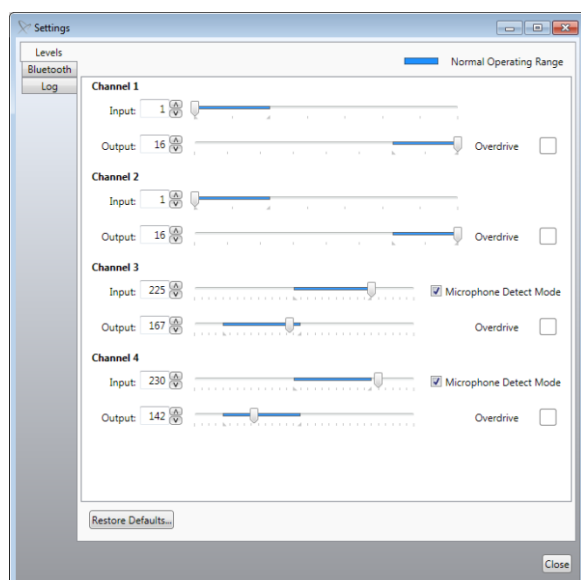


Figure 7-10 - Levels Tab of TestSettings Dialog

- **Bluetooth** – Use this tab to pair, adjust or view information for Bluetooth-connected test devices. See [Section 5.2.7](#) for more information on using the **Bluetooth** dialog.

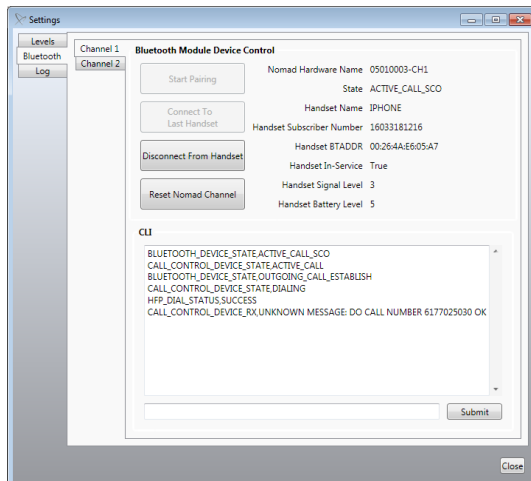


Figure 7-11 - Bluetooth Tab of TestSettings Dialog

- **Log** – This tab provides a log of system events during a **Voice Quality** task.

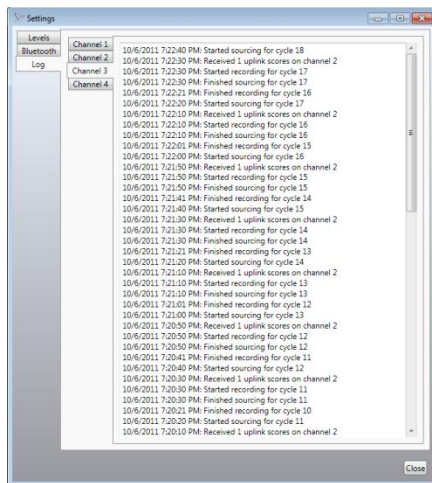


Figure 7-12 - Log Tab of TestSettings Dialog

H. Help

- This option opens the Online Help file for Nomad.

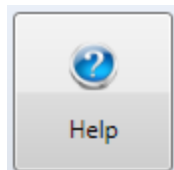


Figure 7-13 - Help Button

I. Call Performance Task Status Window (Mobile Originated Task)

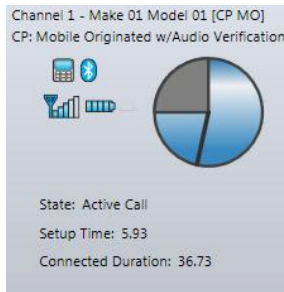





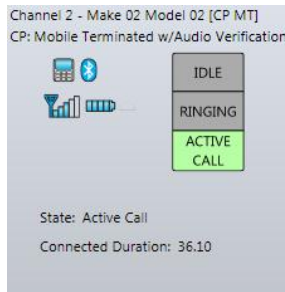







Figure 7-14 - Call Performance Task Status Window (Mobile Originated Task)

- Call Performance test status items displayed in this area:
 - **State** – The state of the call, typically listed as **Waiting**, **Connecting** or **Active Call**.
 - **Actual Wait Duration** – The amount of time the phone has spent in **Wait** mode.
 - **Connected Duration** – The amount of time spent on the call.
 - **Setup Time** – The amount of time between the start of the call attempt and the call connection.
 - **Wait Time Remaining** – The amount of idle time until the next call attempt.
- Call Performance indicators displayed in this area:
 - **Device State Indicator**  - The device icon will appear when the mobile is actively attempting or connected to a call. The device tooltip provides the actual call state.
 - **Bluetooth State Indicator**  - This indicator will appear in gray when Bluetooth is OFF, and in blue when Bluetooth is ON.
 - **Note:** If the Bluetooth connection drops during the test, Nomad will attempt to automatically reconnect. This feature is device dependent and only possible on phones which support automatic Bluetooth reconnection. Phones that do not support automatic reconnection will prompt the user to manually reconnect when Bluetooth is lost. Other models give the user the option to override manual reconnection and take advantage of Nomad's automatic reconnection.
 - **Signal Strength Indicator**  - The signal strength indicator mimics the mobile's signal strength bar display. The mouse-over tooltip provides the number of bars reported. Note that signal strength reporting varies widely by device and is not supported by all device types.
 - **Battery Indicator**  - The battery indicator mimics the mobile's battery bar display. The mouse-over tooltip provides the number of bars reported. Note that battery performance reporting varies widely by device and is not supported by all device types. Charging the battery during testing may cause misleading battery performance results for some phones.
 - **RSSI Indicator**  - This indicator appears as a gauge measuring the RSSI reported by the handset. The mouse-over tooltip provides the actual RSSI level. This feature is device-dependent and only appears for phones that support RSSI reporting.

J. Call Performance Task Status Window (Mobile Terminated Task)

**Figure 7-15 - Call Performance Task Status Window (Mobile Terminated Task)**

- Call Performance test status items displayed in this area:
 - **State** – The state of the call, typically listed as **Waiting for Next Call (Idle)**, **Ringling** or **Active Call**
 - **Connected Duration** – The amount of time spent on the call.
- Call Performance indicators displayed in this area:
 - **Device State Indicator**  - The device icon will appear when the mobile is actively attempting or connected to a call. The device tooltip provides the actual call state.
 - **Bluetooth State Indicator**  - This indicator will appear in gray when Bluetooth is OFF, and in blue when Bluetooth is ON.
 - **Note:** If the Bluetooth connection drops during the test, Nomad will attempt to automatically reconnect. This feature is device dependent and only possible on phones which support automatic Bluetooth reconnection. Phones that do not support automatic reconnection will prompt the user to manually reconnect when Bluetooth is lost. Other models give the user the option to override manual reconnection and take advantage of Nomad's automatic reconnection.
 - **Signal Strength Indicator**  - The signal strength indicator mimics the mobile's signal strength bar display. The mouse-over tooltip provides the number of bars reported. Note that signal strength reporting varies widely by device and is not supported by all device types.
 - **Battery Indicator**  - The battery indicator mimics the mobile's battery bar display. The mouse-over tooltip provides the number of bars reported. Note that battery performance reporting varies widely by device and is not supported by all device types. Charging the battery during testing may cause misleading battery performance results for some phones.
 - **RSSI Indicator**  - This indicator appears as a gauge measuring the RSSI reported by the handset. The mouse-over tooltip provides the actual RSSI level. This feature is device-dependent and only appears for phones that support RSSI reporting.

K. Call Performance Statistics Window

- For **Mobile Originated** calls, this window displays the current test progress along with Call Performance statistics.
- For **Mobile Terminated** calls, only those fields for which data is available at the mobile end will be populated in this window during testing. The remaining fields will display as PENDING during the test. The statistics for these fields will be compiled in the formatted output report generated at the conclusion of testing. The affected fields are:
 - Average Access Time
 - Failed Attempts
 - No Service
 - Access Timeout
 - Dropped (Count)

Statistics		
Channel	Channel 1	Channel 2
Task Type	CCAE_MO	CCAE_MT
Cycle Number	2 / 100	2 / 100
Total Call Duration	00:00:54	00:00:56
Average Access Time	5.14	PENDING
Total Attempts	1	1
Verified Audio Count	2	1
Successful Attempts	100.00 %	100.00 %
Failed Attempts	0.00 %	PENDING
No Service	0.00 %	PENDING
Access Timeout	0.00 %	PENDING
Dropped (Count)	0	PENDING
Physical Errors (Count)	0	0
Logical Errors (Count)	0	0
BC Errors (Count)	0	0

Figure 7-16 - Call Performance Statistics Window

L. Voice Quality Task Status Window

- Status for the current Voice Quality cycle is noted here as one of the following options:
 - **Waiting** – This state indicates that the call has been placed midway through one of the Sourcing/Recording cycles. Nomad will remain idle until the start of the next full Sourcing/Recording cycle, at which point data capture will begin.
 - **Recording** – In this state, Nomad is currently recording the .WAV file that the mobile receives from the Audio Server to be using for downlink MOS scoring.
 - **Sourcing** – In this state, Nomad is sourcing the reference audio file to the mobile to be transmitted to the Audio Server and used for uplink MOS scoring. *Note that the waveform and audio playing during this state represent the **downlink** audio recorded in the previous 10 second window. In parallel with the audio playback, Nomad sources a 'perfect' audio clip for uplink transmission that is inaudible to the user.*
- The waveform playback seen here represents the audio recorded by Nomad in the previous 10 second time window. This playback occurs in parallel with audio clip sourcing. Audio sourcing is not audible to the user, but is noted as **Sourcing** in this window.
- **MOS** represents the score of the current speech waveform being displayed. A MOS value of 3.500 or higher generally indicates good voice quality. The color of the MOS area represents the **MOS Thresholds** configured on the **Settings** → **Voice Quality** tab.
- **Ins Gain (PESQ) or Attenuation (POLQA)**
 - **Insertion Gain** provides the amplitude of the current waveform when the PESQ scoring algorithm is in use. **Ins Gain** measures the gain that Nomad has applied to the downlink voice signal. For the best results, Spirent Communications recommends maintaining downlink insertion gain between -7 and 0 dB, ideally as close to 0 dB as possible. Increase **Input Level** to increase **Ins Gain** toward 0 dB.
 - **Attenuation** provides the amplitude of the current waveform when the POLQA scoring algorithm is in use. **Attenuation** measures the downlink signal gain reduced by Nomad. For the best results, Spirent Communications recommends maintaining downlink attenuation between 0 and 7 dB, ideally as close to 0 dB as possible. Increase **Input Level** to decrease **Attenuation** toward 0 dB. Note that compared to PESQ, POLQA is more forgiving when it comes to attenuation adjustment.
- **Avg MOS** indicates the average of all MOS values collected during the current test session.
- **Std Dev** indicates the spread of the MOS values about the average.
- **Algorithm** displays the scoring algorithm as PESQ or POLQA. See [Appendix E](#) for an introduction to POLQA including a comparison between PESQ and POLQA.
- Select **Monitor Audio** to listen to waveform playback for the current test channel. Audio may be monitored for one test channel at a time.



Figure 7-17 - Voice Quality Task Status Window

M. MOS Trends Window

- Select **Session** to view the downlink or uplink measurement history for all handsets performing **Voice Quality** testing.

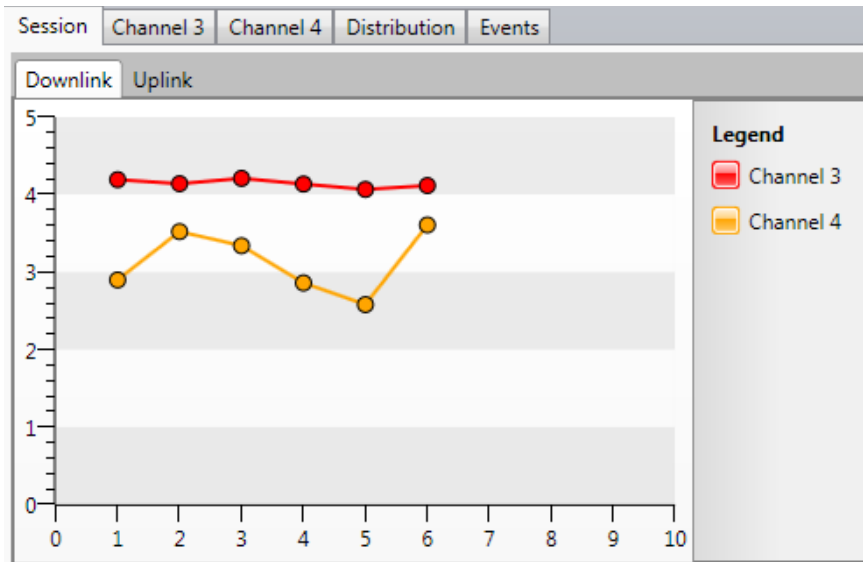


Figure 7-18 - MOS Session Window

- Select an individual channel (**Channel 1 / Channel 2 / Channel 3 / Channel 4**) to view the measurement history for that handset for the current test session. Both the downlink and uplink history will be displayed here. Click on any data point to view and replay the .WAV file associated with that point. Hover over any data point for statistics for that test cycle. The **Number Calling From**, **Number Called** and **Avg. Uplink MOS** are displayed below the chart.

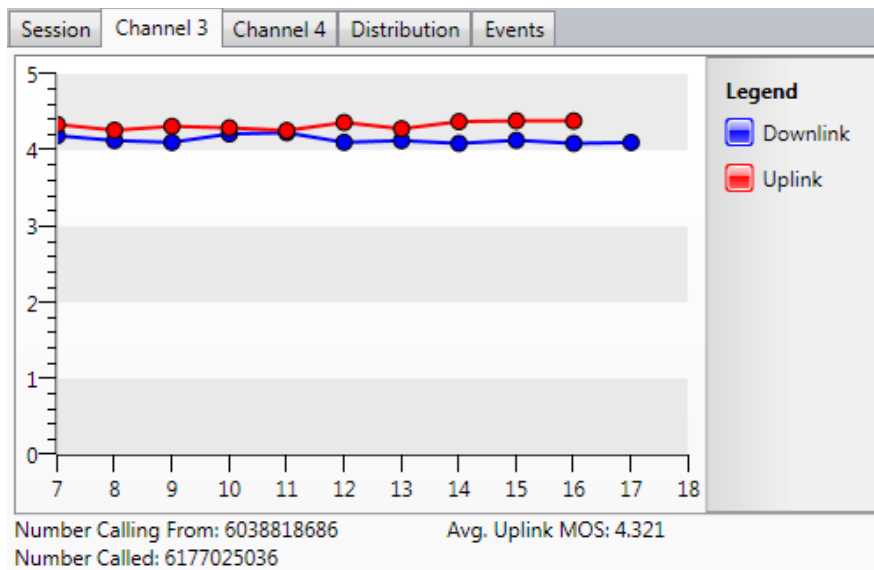


Figure 7-19 - Individual MOS Trend Window

- Select **Distribution** to view the spread of downlink or uplink MOS values for all handsets in the current test session.

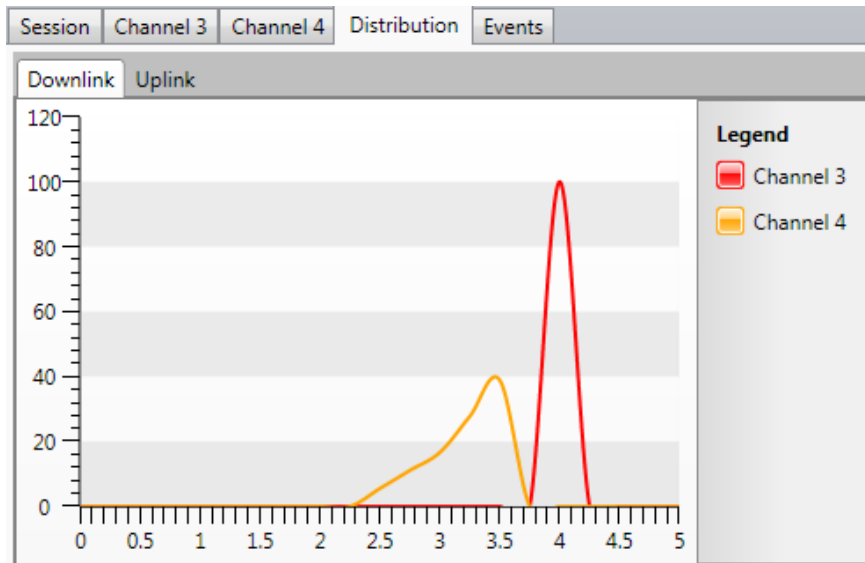


Figure 7-20 - MOS Distribution Window

- The **Events** tab displays null MOS events automatically detected by Nomad as well as events manually recorded by the user. See [Section 7.3](#) for details on event logging and event detection.

The figure is a table titled 'Events Window'. It has five tabs: 'Session', 'Channel 3', 'Channel 4', 'Distribution', and 'Events'. The 'Events' tab is selected. The table has four columns: 'Cycle', 'Channel 3', 'Channel 4', and 'Notes'. It contains 10 rows of data. Row 6 has a note 'Poor RF Coverage Area'.

Cycle	Channel 3	Channel 4	Notes
1	4.135	3.639	
2	4.135	3.680	
3	4.106	3.623	
4	4.118	3.661	
5	4.050	3.091	
6	4.038	3.463	Poor RF Coverage Area
7	4.190	3.459	
8	4.126	3.547	
9	4.102	3.340	
10	4.213	3.039	

Figure 7-21 - Events Window

7.2 Manual Volume Adjustment (Voice Quality Testing)

Although Spirent recommends running the **Auto-Level Assist Wizard** (see [Section 5.2.5](#)) prior to **Voice Quality** testing to find optimal downlink and uplink volume settings, manual volume adjustment may be necessary to fine-tune the results. Manual volume adjustment may be used in lieu of Auto Level Assist for analog connections, and must be used in the case of a Bluetooth connection. Auto Level Assist is not available for Bluetooth¹.

7.2.1 Manual Downlink Volume Adjustment

Downlink volume can be adjusted manually in two fashions:

- Using the handset's volume control.
- Using the **Settings** → **Levels** tab during testing to adjust the **Input Level** for the channel of interest.

Spirent Communications strongly recommends testing with the handset volume set one level below the maximum, and making further adjustments using the **Input Level** controls.

7.2.1.1 Downlink Volume Adjustment for Bluetooth Connections

In most cases, volume adjustment is not necessary for a channel using a Bluetooth connection.

- In cases where the downlink insertion gain or attenuation for a Bluetooth channel is very far from 0 (roughly less than -8 dB for insertion gain or greater than 8 dB for attenuation) the **Input Level** may be adjusted on the **Levels** tab by moving the slider one or two notches to the right.
- The slider should be kept within the **Normal Operating Range**.
- If MOS deteriorates after the adjustment, return the **Input Level** to the original value.



Figure 7-22 - Bluetooth Volume Controls

¹ Volume adjustment for a Bluetooth connection operates differently than for an analog connection. Over a Bluetooth connection, Nomad captures a digital representation of what the handset manufacturer intended to be sent rather than the incoming voice sample. Instead of having an analog signal that can be amplified directly, the digital signal must be amplified by changing the received bit representation. The leading bits of the 16-bit representation are removed to make the remaining signal “louder”. This logarithmic scaling of the digital signal does not provide the precision available when fine-tuning an analog signal.

7.2.1.2 Downlink Volume Adjustment for Analog Connections

To manually find the optimal downlink volume for any analog channel using the **Levels** dialog:

- For the channel of interest, move the **Input Level** slider to the far right such that the **Overdrive** light illuminates in the GUI and a red light appears for that channel on the hardware unit.
- Move the **Input Level** slider to the left one notch at a time and observe the **Overdrive** indicator during the **Recording** state.
- The first position at which the **Overdrive** light stays off for the current and next recording cycle should be used as the **Input** setting.

For most handsets, the **Input Level** will fall within the **Normal Operating Range** of 170-225 shown on the slider. The downlink **Insertion Gain** or **Attenuation** shown in the Task Status Window will likely read around 0. If the **Overdrive Indicator** illuminates for any channel, decrease the **Input Level** control gradually until it goes off. Note that any adjustment will take effect in the next audio cycle.



Figure 7-23 - Analog Volume Controls

7.2.2 Manual Uplink Volume Adjustment

In both the analog and Bluetooth connection cases, uplink volume adjustment is necessary only if uplink MOS values are unexpectedly poor. If this is the case, move the **Output Level** slider in the **Settings** → **Levels** dialog within the **Normal Operating Range**. If uplink MOS deteriorates after the adjustment, return the **Output Level** to the original value.

7.3 Event Logging and Event Detection (Voice Quality Testing)

Events that occur during a **Voice Quality** test call complement MOS measurements to provide an overall indication of handset performance. Unlike RF collection tools, Nomad's **Voice Quality** task does not have access to protocol layer information traditionally used to detect handset events such as dropped calls. Nomad does provide the ability to note events of interest on both a per-channel and per-cycle basis during a **Voice Quality** task. Nomad also provides the ability to automatically detect a sequence of null MOS scores, often indicative of a dropped call.

Event logging and event detection takes place in the **Events** tab of the **MOS Trends Window** during **Voice Quality** testing.

To manually note a channel-specific event of interest:

- View the **Events** tab of the **MOS Trends Window**.

Session	Channel 3	Channel 4	Distribution	Events
Cycle	Channel 3	Channel 4	Notes	
1	4.135	3.639		
2	4.135	3.680		
3	4.106	3.623		
4	4.118	3.661		
5	4.050	3.091		
6	4.038	3.463	Poor RF Coverage Area	
7	4.190	3.459		
8	4.126	3.547		
9	4.102	3.340		
10	4.213	3.039		

Figure 7-24 - Events Tab

- Click on the cell corresponding to the cycle and channel of interest.
- In the **Event Classification** dialog, select an event to add.

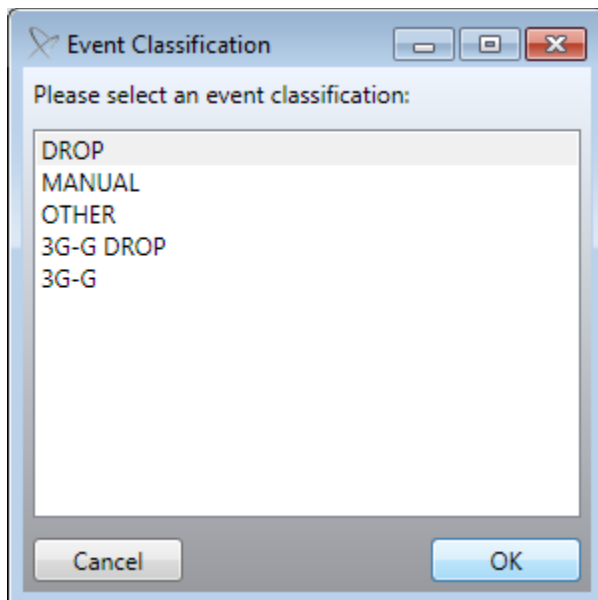


Figure 7-25 - Event Classification Dialog

- The selected event will appear in the cell. Any channel-specific event entry in the event log will replace the MOS entry for that position in the merged output (see [Section 8.1](#)). Affected data points will not be used to calculate MOS summary statistics.
- The events in the **Event Classification** dialog may be customized using the **Settings** → **Voice Quality** tab when no test is in progress. See [Section 4.4.2](#) to learn how to customize the Event Classification options.

To manually note an event that pertains to all channels at a given timestamp (cycle-specific event):

- In the **Events** tab of the **MOS Trends Window**, click on the **Notes** column at the timestamp of interest.
- Enter notes in the **Cycle Notes** dialog and click **OK**.
- The recorded notes will appear in the **Event Window** and will be added to the summary report created with the merge utility. These notes will not replace MOS values for the affected cycles. MOS results for these cycles will be written to the report and included in all summary calculations.

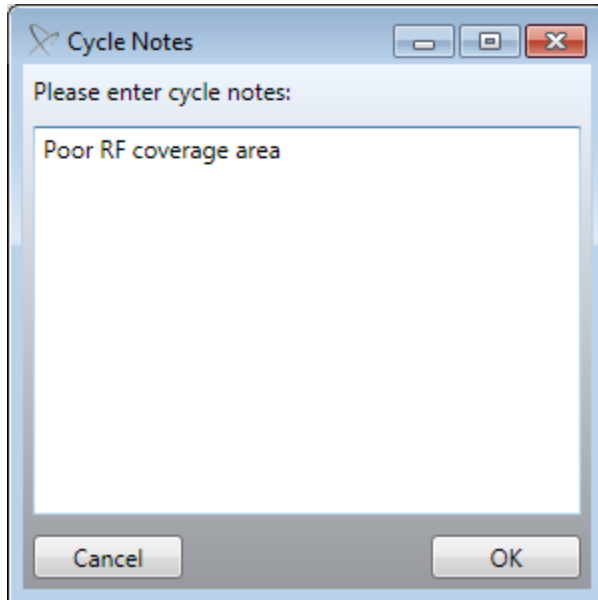


Figure 7-26 - Cycle Notes Dialog

To automatically detect null MOS events:

- While no test is in progress, configure the **Events** area of the **Settings** → **Voice Quality** tab to **Enable Event Detection** as described in [Section 4.4.2](#).
- During subsequent testing, null events will be automatically entered in the Events tab of the MOS Trends Window as channel-specific events. Like channel-specific events that are manually entered, these events will replace the corresponding MOS entry in the summary report and will not count toward calculation of results.

7.4 Interpreting MOS Results (Voice Quality Testing)

Nomad provides audio quality scores using either PESQ P862.1 MOS or POLQAP.863 MOS as selected by the user². Both standardized models for predictive speech quality utilize speech signals that are subjected to the communications link under test and compare the degraded speech to the original speech. Both models provide speech quality on a 5-point scale:

Score	Quality of Speech
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad


See [Appendix E](#) for an introduction to POLQA including a comparison between PESQ and POLQA.

When interpreting results during live collection or in a summary report (see [Section 8.1](#)), the highest MOS values represent the best quality of speech. Although the determination of “acceptable” or “poor” scores is somewhat subjective, the following guidelines represent a general rule of thumb:

- A MOS value of 4.5 or higher represents virtually perfect audio.
- A MOS value of 3.500 or higher generally indicates good voice quality.
- A MOS value of 3.000 or higher generally indicates poor voice quality with degradation audible to the end user.

² POLQA scoring is available as an optional upgrade. Please contact your Spirent Communications representative for more information about this option.

8 Analyzing the Results

Once a suitable amount of data has been collected, use the **Stop**  button to terminate data collection. If the current test has been set to end after a specific number of cycles or calls, data collection will stop automatically at the conclusion of the test sequence.

When a Voice Quality test is stopped, the **End Active Calls** dialog will appear. It is critical to hang up all active Voice Quality calls before clicking **OK** to close this dialog. Failure to disconnect the calls prior to closing this dialog will result in data missing from the merged output report.

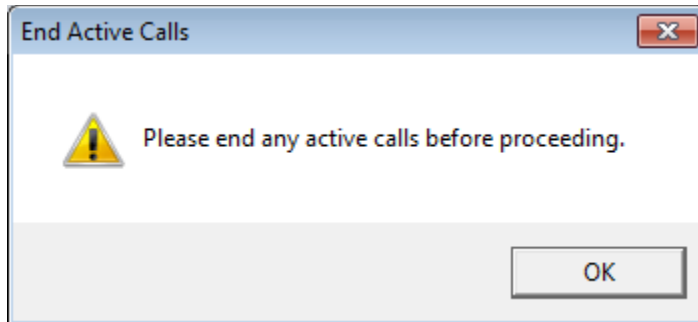


Figure 8-1 - End Active Calls Dialog

When data collection stops, the Nomad **Data** tab will appear for report generation and additional analysis.

8.1 Generating a Report

In most cases, Nomad will automatically merge the downlink data collected at the test PC with the uplink data collected at the Audio or Call Server provided that an internet connection is available at merge time. The merged file will be listed on the **Data → Complete** tab and will be available for report generation. In addition to the **File Name**, the **UTC Start Time** and **End Time** and the task type performed at each channel is listed for identification purposes. The listed reports may be sorted using the column headers (If the session file appears on the **Data → Incomplete** tab, see [Section 8.8](#) for troubleshooting tips).

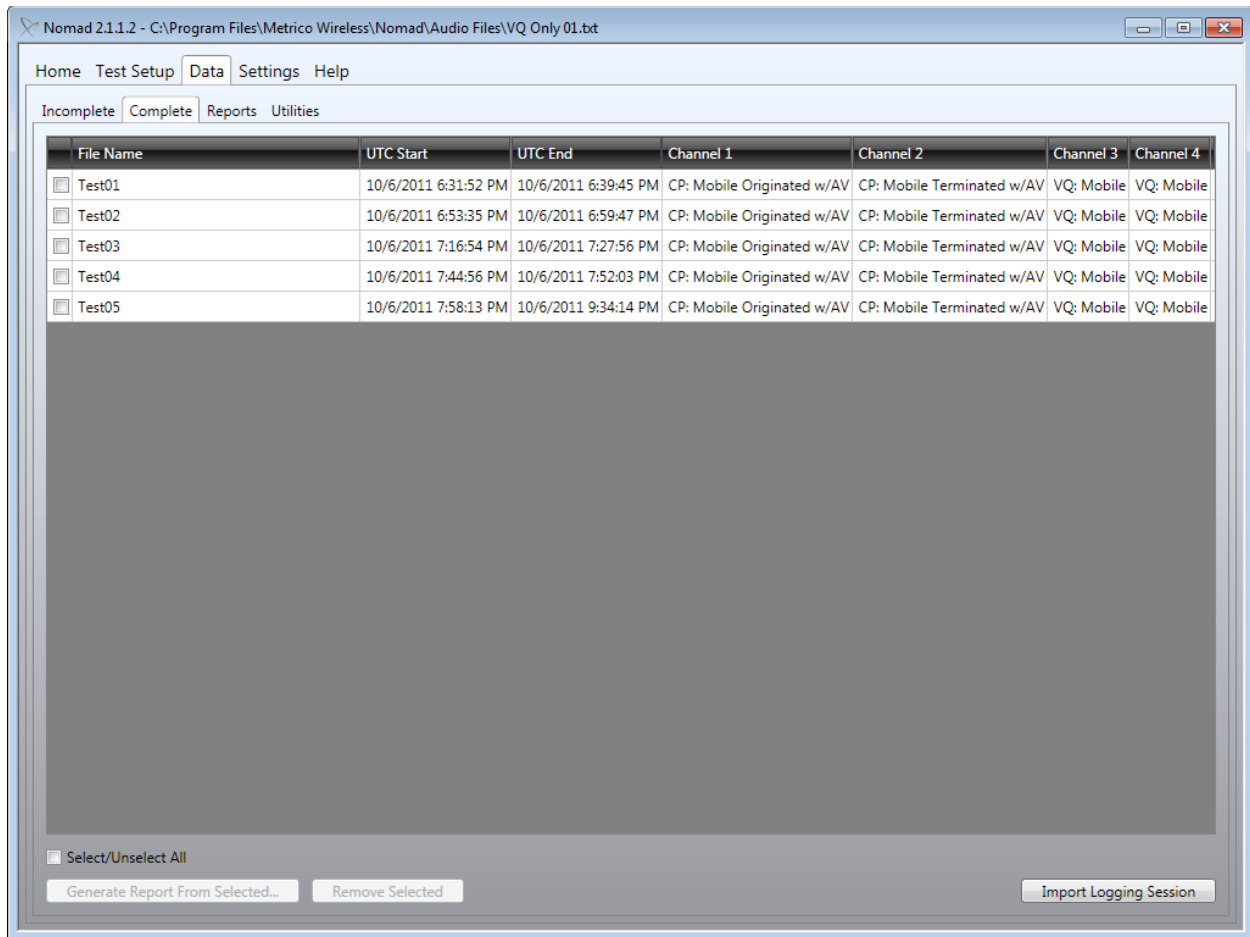
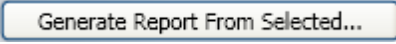


Figure 8-2 – Merged Session Files on the Complete Tab

To generate a report using merged session files:

- Select one or more files to be included in the output report.
- Click the **Generate Report From Selected**  button.
- If multiple session files have been selected, choose whether to **Merge multiple logging sessions into one report** or to **Produce one report for each logging session**.

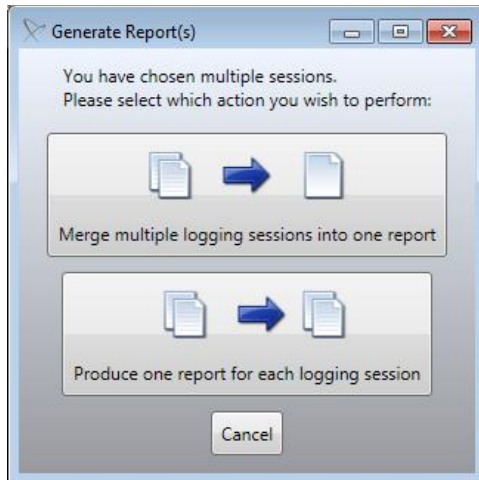


Figure 8-3 - Output File Type Selection

- The **Review Merged Session Report Header Data** dialog will appear. Channels with inconsistent header data will be highlighted **yellow**. This dialog may also be used to move data among channels for reporting purposes.
 - Examine the data for any marked inconsistencies. Remove any unwanted data from the merge or use the **Move Selected** button to move data to a different channel. Moving data may be necessary if the same device was used on different channels during different test sessions.
 - The **Move Selected** button may also be used to move data among channels for reporting purposes. Use this option to aggregate data collected across multiple channels in the report output.
 - Provide a unified **Name** for the channel data in the report.
 - Click **Generate Report** when all data has been aligned as desired.
- If multiple test session files have been selected, the **Save As** dialog will appear. Name the Nomad report source file, or text file containing all data for the unified output report.

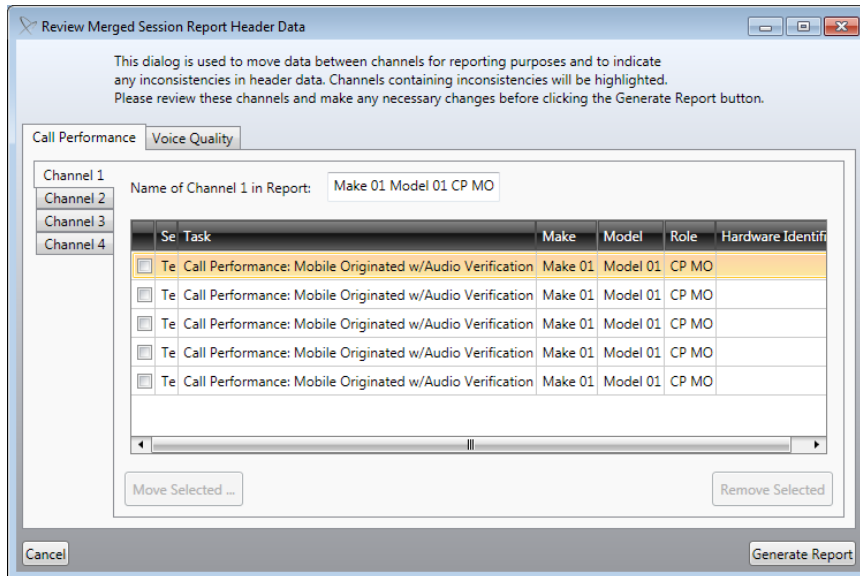


Figure 8-4 - Review Merged Session Report Header Data Dialog

- The source files used to generate the formatted output report and KML file for geographic visualization of MOS data will be listed on the **Data** → **Reports** tab. A report file created from a single test file will take the name of that file. A report file created from multiple test files will take the name assigned by the user during the report generation process.

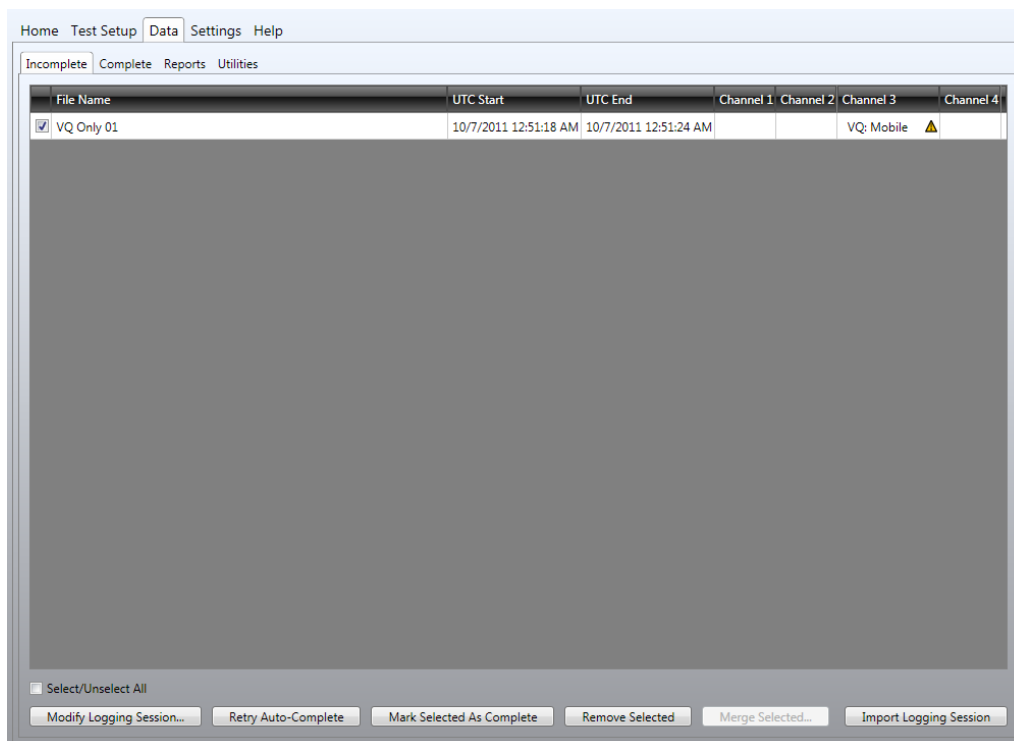
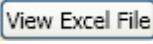


Figure 8-5 - List of Generated Reports on the Reports Tab

8.2 Displaying a Formatted Report

To display the formatted report output:

- On the **Data** → **Reports** tab, click the **View Excel File**  button for the data of interest.
- **Note:** If the **View Excel File** button is not present, reports must be generated by a team member with access to this functionality. Contact Spirent Support if you believe this capability has been omitted in error.
- In the **Save As** dialog, provide a name for the formatted Excel report.
- **Note:** Formatted output reports are displayed in **.XLSX** format. Microsoft Excel 2007 or newer is required to open files in this format. If you are running an older version of Excel, you must download the Microsoft Excel Viewer to view the **.XLSX** output reports.

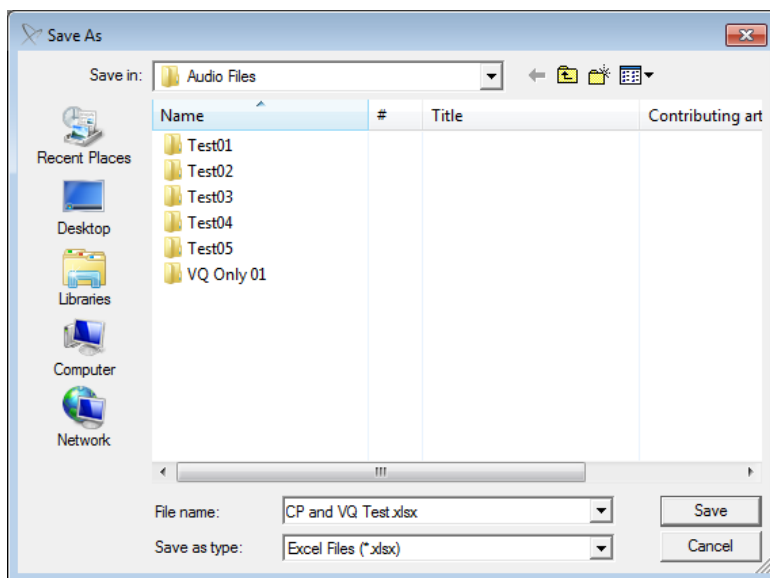


Figure 8-6 - Naming the Formatted Excel Report

- Nomad supports report template customization. If multiple customized report templates are available, the **Report Template Selection** dialog will appear. Select the desired template to use. See [Section 8.3](#) for details on customizing report templates.

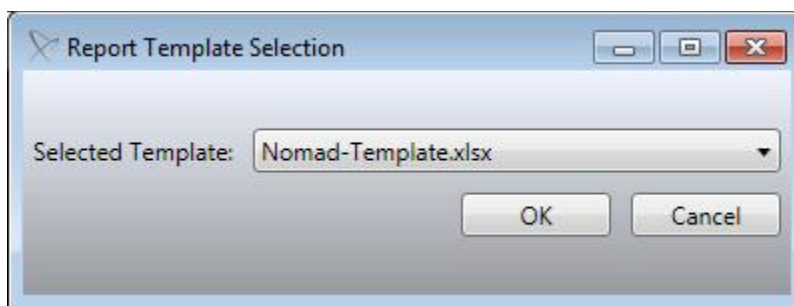



Figure 8-7 - Report Template Selection Dialog

The report will open to the **Device Overview** tab. This page lists the metadata entered for each test device, and provides links to each of the Voice Quality and Call Performance reports. Click on any report **Name** to go directly to that report.



Device Overview and Report Index

	Channel 1	Channel 2	Channel 3	Channel 4
Make	Make 1	Make 2	Make 3	Make 04
Model	Model 1	Model 2	Model 3	Model 04
Role	CP - MO	CP - MO	VQ	VQ DUT
Hardware Identifier	001C1326C445	001B5258AFA8	00264A860SA7	00249FEE1FFF
Adapter	N/A	N/A	N/A	N/A
Number to Dial	8882087217	8882087219	6172742057	6172742049
Number Dialing From	6033189022	6033181227	6038817575	4438786157
End Input Level	N/A	N/A	255	225
End Output Level	N/A	N/A	155	165

Click any report **Name** below to view the report:

Name	Test Type	Description
Voice Quality Summary	Voice Quality	Statistical and distribution information for uplink and downlink MOS results
Detailed MOS Data	Voice Quality	Detailed MOS result data for each channel ordered by time
Delay Performance Summary	Delay	Statistical information for Delay Task results
Detailed Delay Data	Delay	Detailed Delay result data
Call Performance Summary	Call Performance	Provides a snapshot of the Failed Initiation and Dropped Call Rate
Call Initiation Performance Report	Call Performance	Provides a breakdown of Call Initiation Failure events by failure type
Call Retention Performance Report	Call Performance	Displays the Dropped Call Rate for each device as the % of successful initiations that result in a dropped call
Audio Verification Performance Report	Call Performance	Displays the Audio Verification Failure Rate based on the number of calls where audio was not detected
Device Performance Report	Call Performance	Summarizes signal strength and battery reports from the device as well as Bluetooth errors.

Figure 8-8 - Device Overview Report Landing Page

Formatted **Voice Quality** data can be found on the **Voice Quality Summary** tab of the output and includes statistical and distribution information for **Voice Quality** session results.

	Downlink MOS				Uplink MOS			
	Model 1 DL	Model 2 DL	Model 3 DL	Model 04 DL	Model 1 UL	Model 2 UL	Model 3 UL	Model 04 UL
Average	3.09	3.62	4.12	3.36	3.57	4.06	4.33	3.34
Standard Deviation	0.42	0.45	0.05	0.30	0.48	0.42	0.05	0.21
Maximum Score	3.56	4.39	4.23	3.80	4.41	4.42	4.44	3.69
Count	381	381	381	98	381	381	381	381
% MOS greater than or equal to 3.2	24.15%	21.52%	25.72%	76.53%	19.16%	8.92%	25.98%	21.52%
% MOS less than 3.0	0.79%	2.36%	0.00%	12.24%	2.10%	0.00%	0.00%	1.84%
% MOS less than 2.0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
% MOS less than or equal to 1.8	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Scoring Algorithm	POLQA	POLQA	POLQA	POLQA	POLQA	POLQA	POLQA	POLQA

Figure 8-9 - MOS Statistical Summary

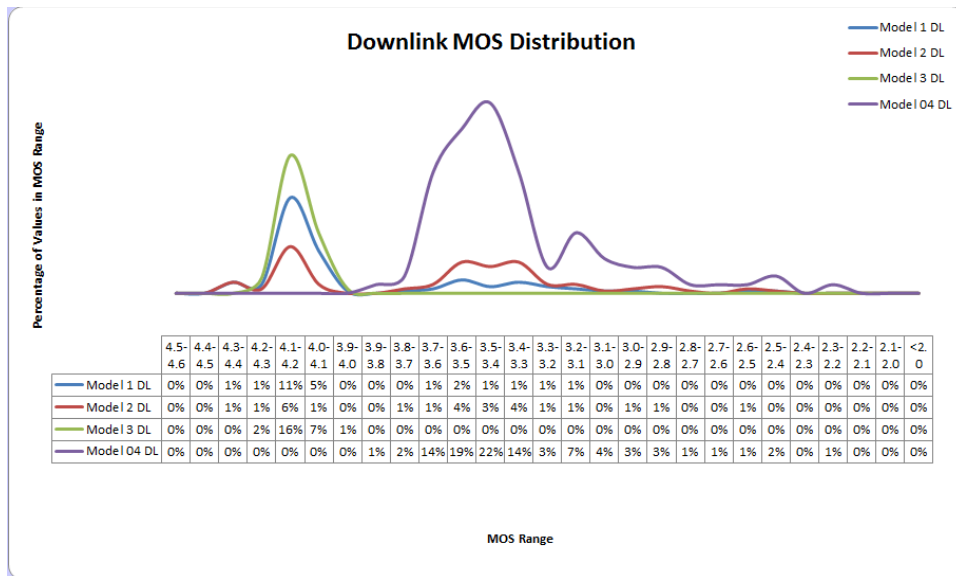


Figure 8-10 - Downlink MOS Distribution

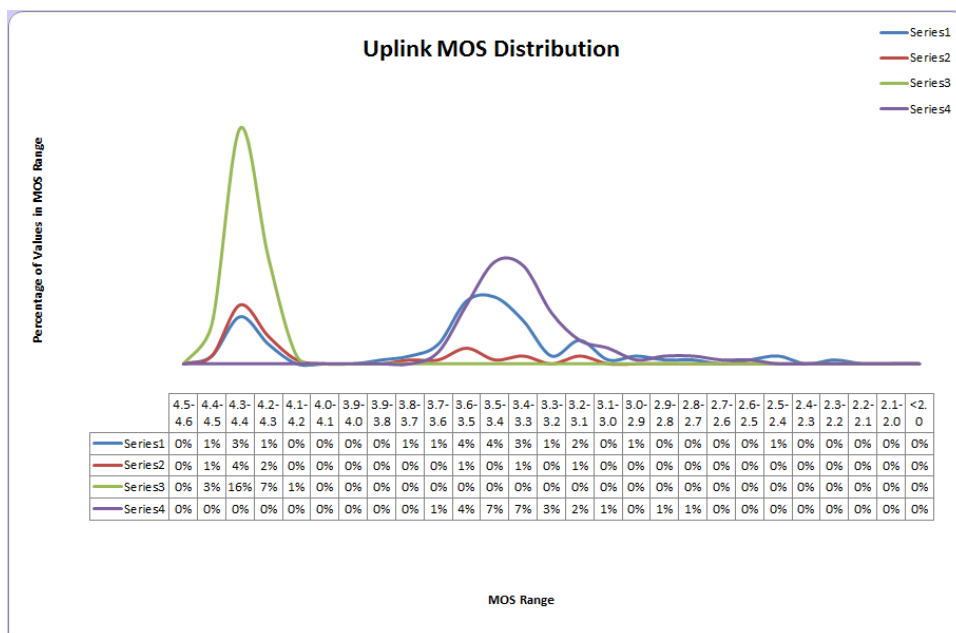


Figure 8-11 - Uplink MOS Distribution

Formatted Delay Performance data can be found on the **Delay Performance Summary** tab.

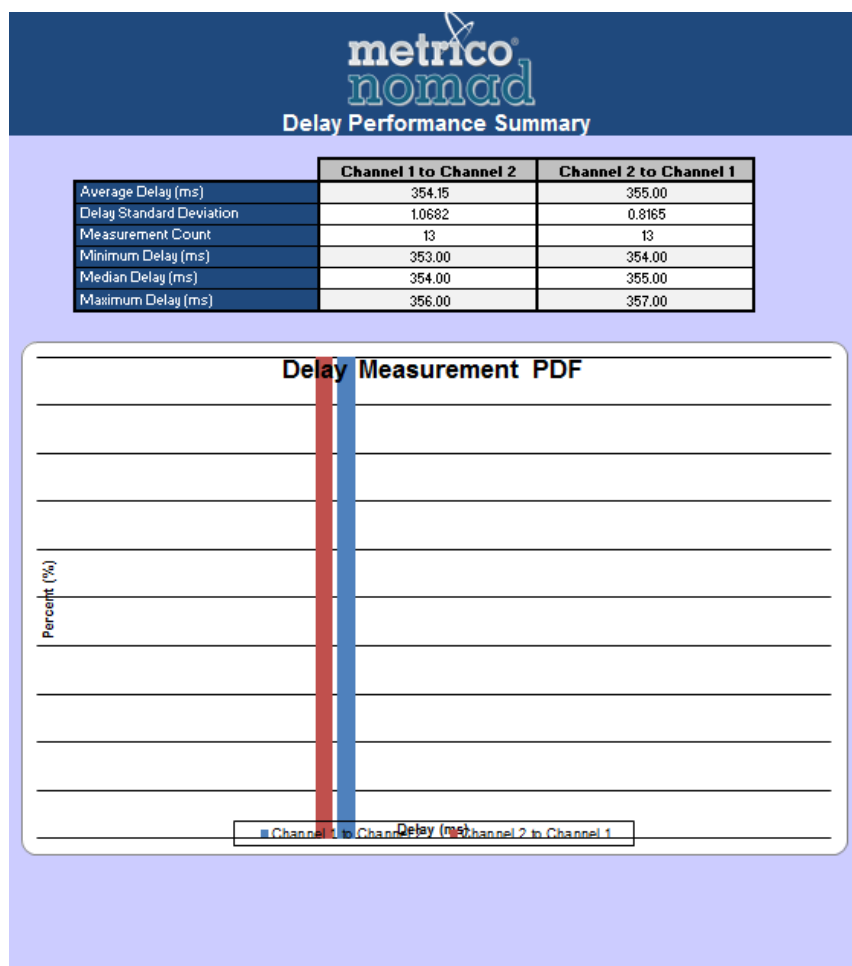


Figure 8-12 - Delay Performance Summary Report

Formatted **Call Performance** data can be found on these tabs:

- Call Performance Summary
- Call Initiation
- Call Retention
- Audio Verification
- Device Performance

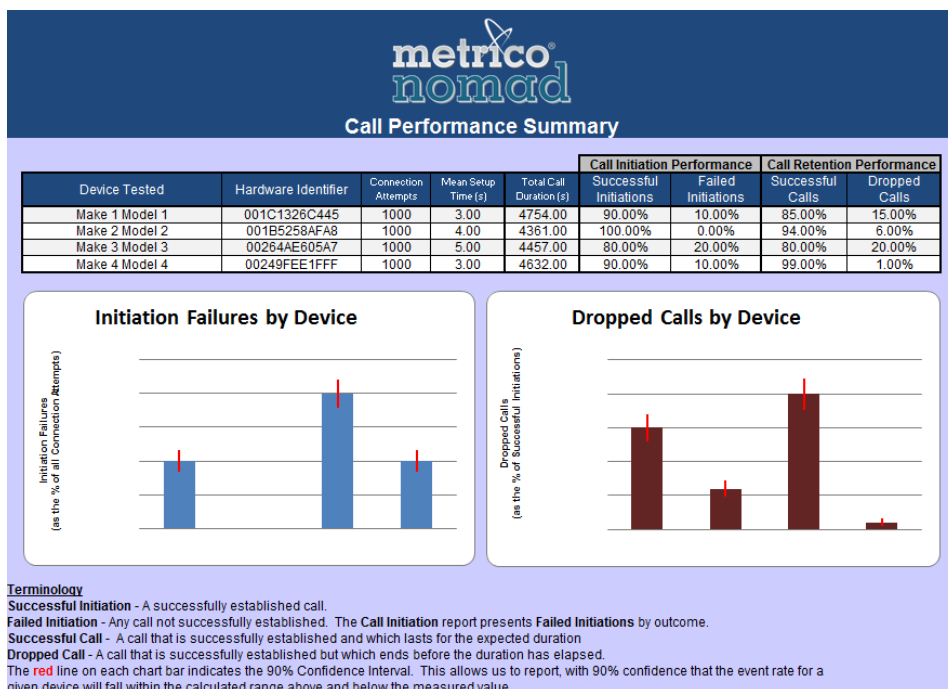


Figure 8-13 - Call Performance Summary Report

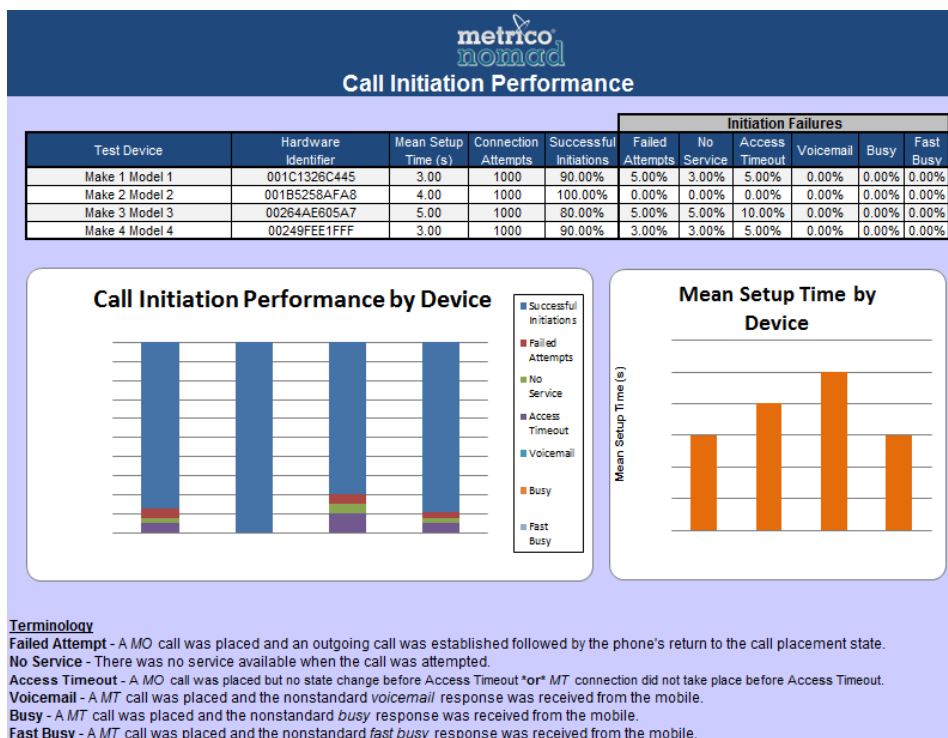


Figure 8-14 - Call Initiation Performance Report

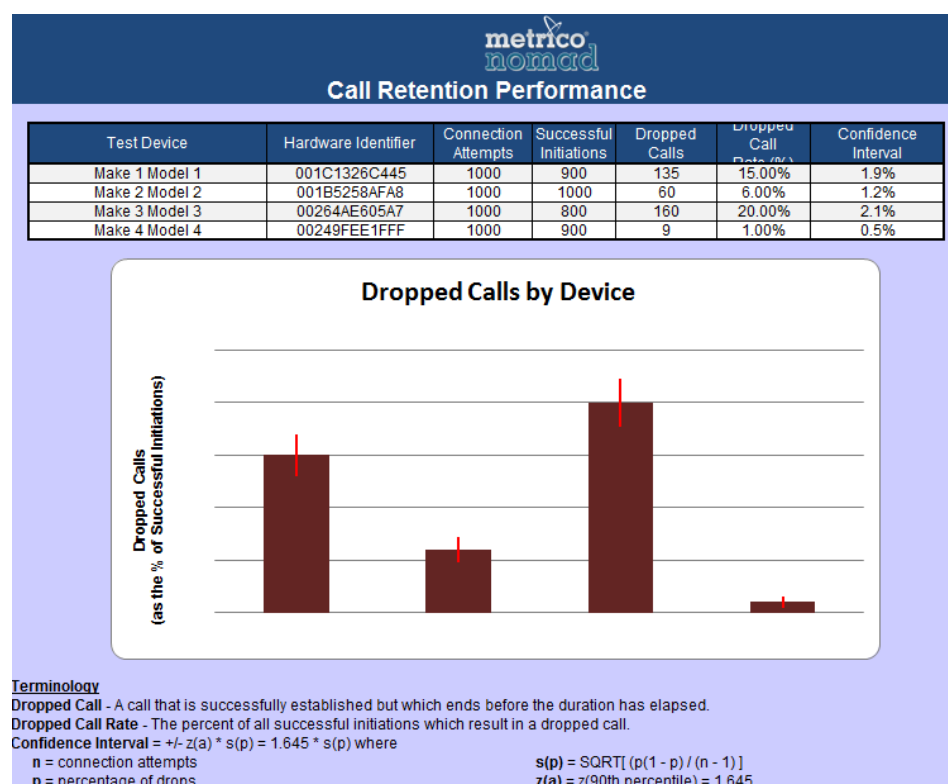


Figure 8-15 - Call Retention Performance Report

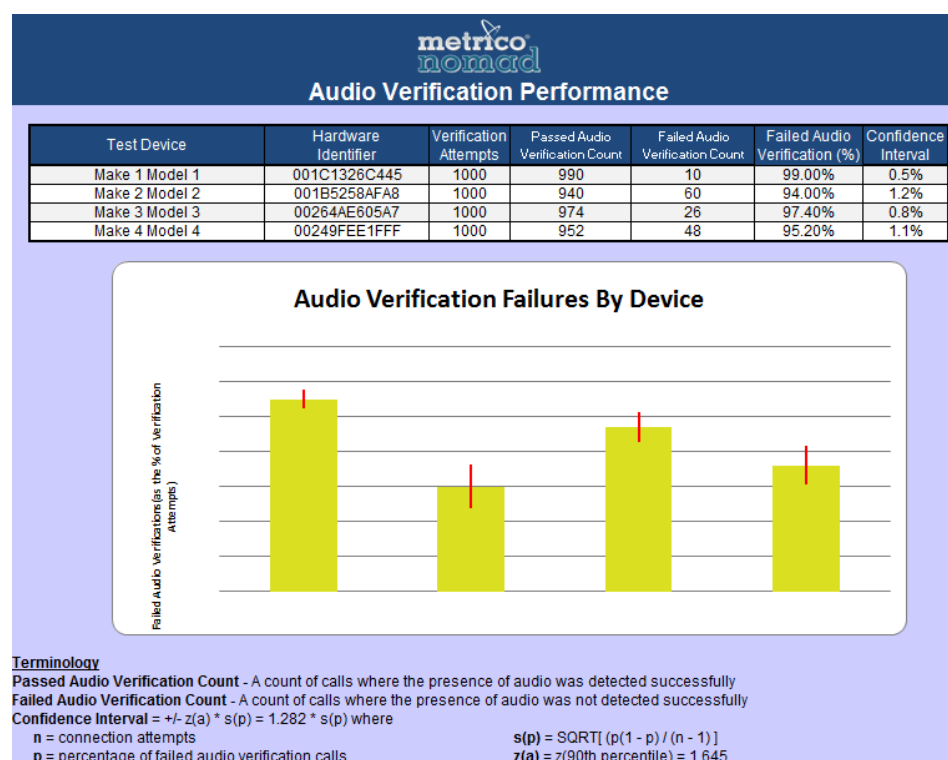


Figure 8-16 - Audio Verification Performance Report

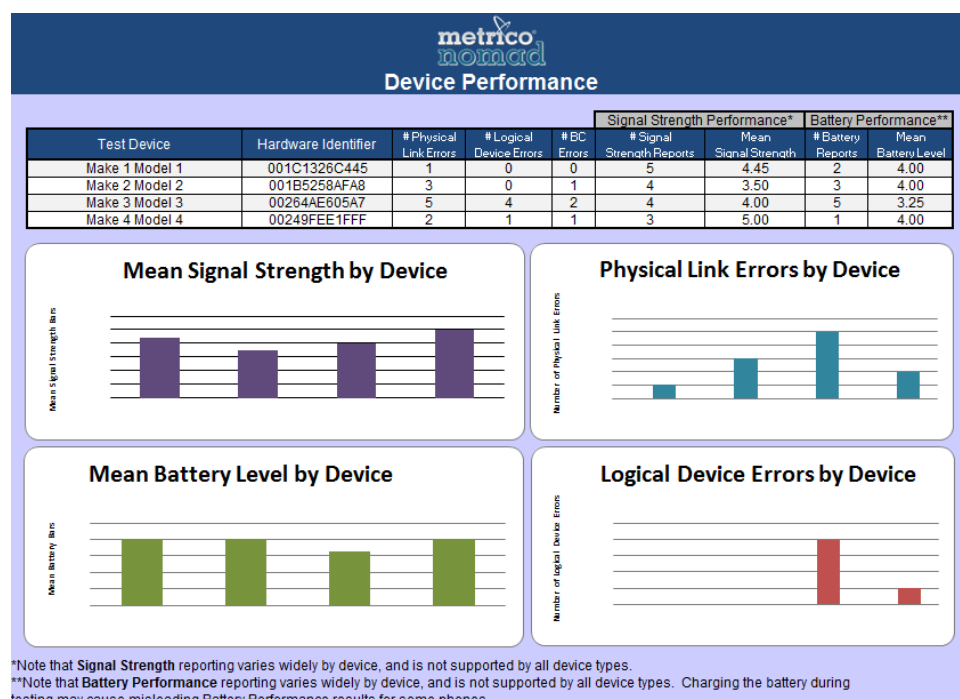


Figure 8-17 - Device Performance Report

8.3 Report Template Customization

Nomad supports report template customization. To customize a report template:

- Find the default Nomad report template in the **Templates** directory of the Nomad installation location (typically **C:\Program Files\Spirent Communications\Nomad**). The name of the file is **Nomad-Template.xlsx**.
- Make a copy of the **Nomad-Template.xlsx** template file in the same directory. Rename the copy with a meaningful name.
- Open the new file and edit the formatted report pages using Excel 2007 (.XLSX format). Note that existing worksheet names must remain the same but new sheets may be added.
- When the changes are complete, save the Excel file.
- When more than one report template is available in the **Templates** folder, Nomad will present the **Report Template Selection** dialog during the report generation process. At that time, any custom template may be selected for data population.

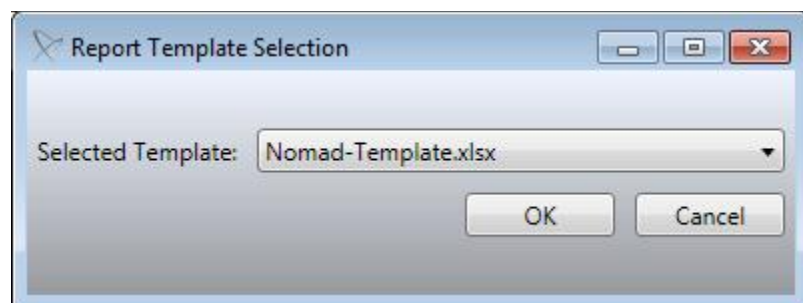


Figure 8-18 - Report Template Selection Dialog


8.4 Visualizing Data Geographically

The Nomad KML output capability provides a simple method of visualizing MOS and Call Performance data geographically.

Google Earth™ must be installed in order to take advantage of geographic visualization. Google Earth™ may be obtained from:

<http://earth.google.com>

An internet connection is required for map access while running the program. To visualize data in Google Earth™:

- On the **Data → Reports** tab, click the **View KML File**  button for the data of interest.
- In the **Save As** dialog, provide a name for the KML map file.

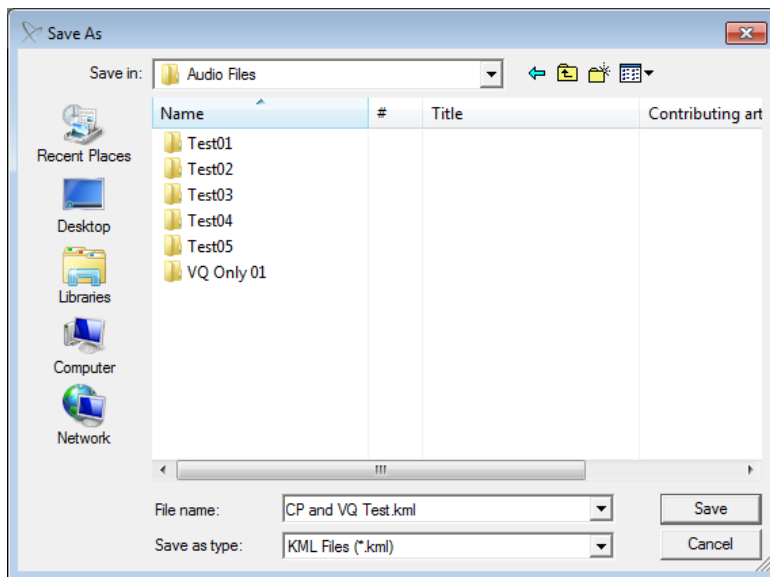


Figure 8-19 - Naming the KML Map File

- The **KML Generation Complete** dialog will appear. Choose whether to view the data now. The data can be viewed at any time by opening the .KML file using the **File → Open** command from the main menu in Google Earth™.

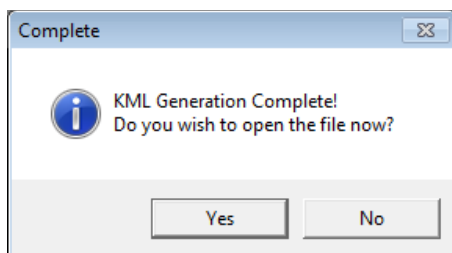


Figure 8-20 - KML Generation Complete Dialog

- Google Earth™ will open and zoom to the map location. MOS measurements or Call Performance events will be shown as color-coded points along the drive route. The color thresholds for each MOS range are determined by the thresholds set on the **Settings** → **Voice Quality** tab (see [Section 4.4.1](#)). Colors for Call Performance events are determined by the system.

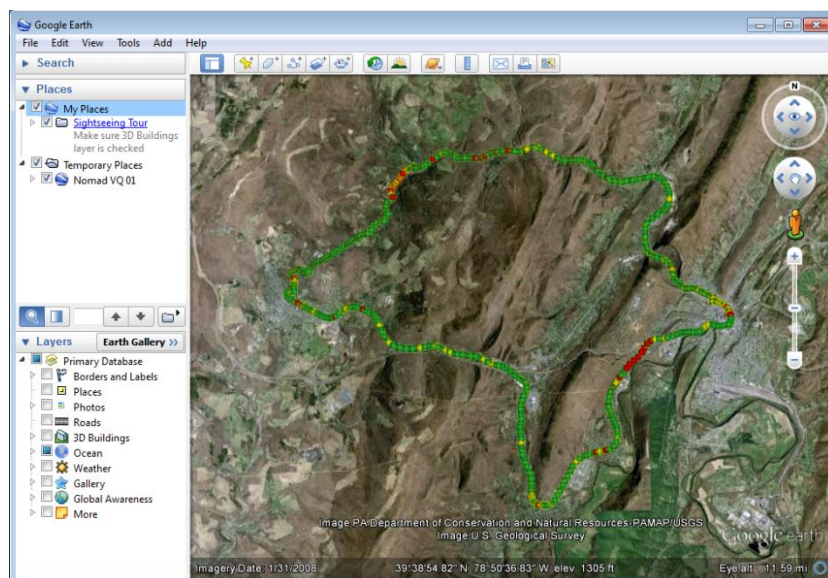


Figure 8-21 - Geographic Display of MOS Data in Google Earth™

- In the **Places** window in the left-hand panel, use the selection boxes to isolate the data by channel and link. For example, this map has been customized to include only Downlink data for Channel 1.

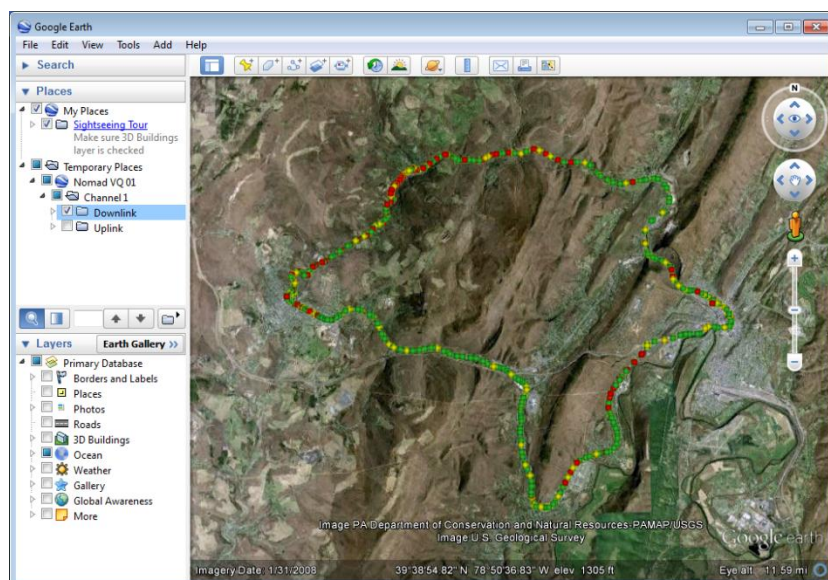


Figure 8-22 - Isolating the Data of Interest

- The map image may be saved as a .JPG file by selecting **File** → **Save** → **Save Image**.

8.5 Collecting Random Audio Sample Files (Voice Quality Testing)

Nomad has the ability to set aside a random sample of audio files from a **Voice Quality** test within each MOS performance range. This allows users to audibly verify the performance of **Great**, **Good** and **Bad** audio samples.

Random audio file sampling must be enabled prior to data collection on the **Settings** → **Voice Quality** tab in order to capture this data (see [Section 4.4.1](#)).

Start and run the test normally. After the uplink and downlink data for the test has been merged and the session file appears on the **Data** → **Complete** tab, a ZIP containing the sample uplink and downlink audio files will be available in the file's details directory. This folder resides in the log file storage location specified in the **Start Logging Session Wizard** (see [Section 6.4](#)) and takes the same name as the session log file. The ZIP file contains a directory structure that organizes the audio samples by channel and by performance threshold. The .WAV audio samples reside within the directory structure.

Some notes about the directory structure containing the audio samples:

- If the specified number of files does not exist for a range, Nomad will include all available .WAV files for that range.
- If no samples fall within a range, no folder will be present for that range.
- The files can be played with any media player that supports .WAV files.

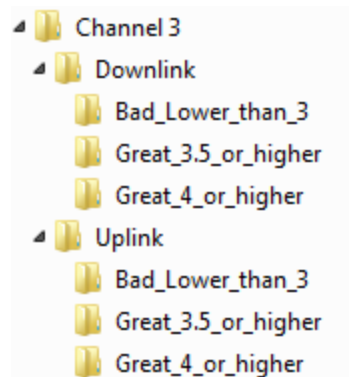
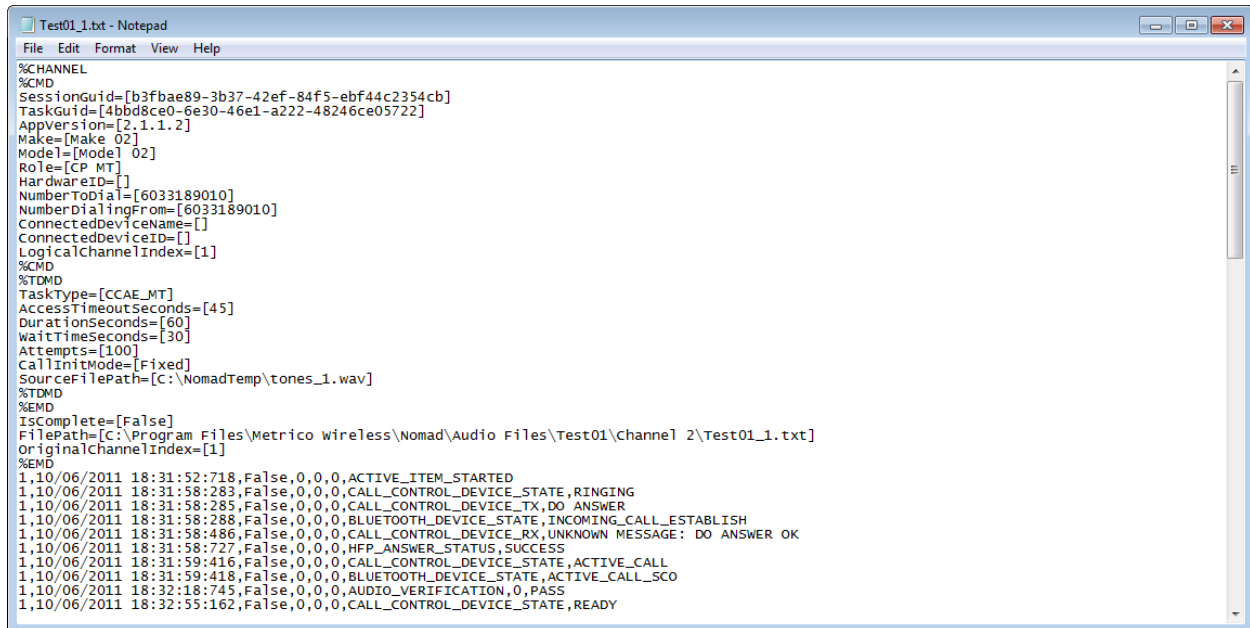


Figure 8-23 - Random Audio Sample Directory Structure

8.6 Viewing the Logs

The log file containing the messaging for each test is stored in the **Log File Storage Location** specified in the **Start Logging Session Wizard** (see [Section 6.4](#)). The log files are maintained in an open-format, comma-delimited file for direct access to the information.



```

Test01_1.txt - Notepad
File Edit Format View Help
%CHANNEL
%CMD
SessionId=[b3fbae89-3b37-42ef-84f5-ebf44c2354cb]
TaskId=[4bbd8ce0-6e30-46e1-a222-48246ce05722]
AppVersion=[2.1.1.2]
Make=[Wake 02]
Model=[Model 02]
Role=[CP_MT]
HardwareId=[]
NumberToDial=[6033189010]
NumberDialingFrom=[6033189010]
ConnectedDeviceName=[]
ConnectedDeviceId=[]
LogicalChannelIndex=[1]
%CMD
%TDMD
TaskType=[CCAE_MT]
AccessTimeoutSeconds=[45]
DurationSeconds=[60]
WaitTimeSeconds=[30]
Attempts=[100]
CallInitMode=[Fixed]
SourceFilePath=[C:\NomadTemp\tones_1.wav]
%TDMD
%EMD
IsComplete=[False]
FilePath=[C:\Program Files\Metrico wireless\Nomad\Audio Files\Test01\Channel 2\Test01_1.txt]
OriginalChannelIndex=[1]
%EMD
1,10/06/2011 18:31:52:718,False,0,0,0,ACTIVE_ITEM_STARTED
1,10/06/2011 18:31:58:283,False,0,0,0,CALL_CONTROL_DEVICE_STATE,RINGING
1,10/06/2011 18:31:58:285,False,0,0,0,CALL_CONTROL_DEVICE_TX,DO ANSWER
1,10/06/2011 18:31:58:288,False,0,0,0,BLUETOOTH_DEVICE_STATE,INCOMING_CALL_ESTABLISH
1,10/06/2011 18:31:58:486,False,0,0,0,CALL_CONTROL_DEVICE_RX,UNKNOWN MESSAGE: DO ANSWER OK
1,10/06/2011 18:31:58:727,False,0,0,0,HFP_ANSWER_STATUS,SUCCESS
1,10/06/2011 18:31:59:416,False,0,0,0,CALL_CONTROL_DEVICE_STATE,ACTIVE_CALL
1,10/06/2011 18:31:59:418,False,0,0,0,BLUETOOTH_DEVICE_STATE,ACTIVE_CALL_SCO
1,10/06/2011 18:32:18:745,False,0,0,0,AUDIO_VERIFICATION,0,PASS
1,10/06/2011 18:32:35:162,False,0,0,0,CALL_CONTROL_DEVICE_STATE,READY
  
```

Figure 8-24 - Nomad Test Log

8.7 Waveform Analysis with the PESQ Tools GUI (Voice Quality Testing)

The **Psytechnics PESQ Tools GUI** is available for Nomad users wishing to perform detailed analysis of any waveform captured during **Voice Quality** testing. PESQ takes into account signal degradation caused by coding distortions, error, packet loss delay and filtering in analog network components. The **PESQ Tools GUI** can be useful in understanding why a sample was scored the way that it was. This section describes the operation of the GUI and the most relevant analyses that can be performed with the tool.

Note: This tool is only applicable to the PESQ scoring method. At this time, there is no comparable tool for POLQA.

Note: At this time, the **PESQ Tools GUI** is not being packaged within Nomad. Please contact Spirent Product Support to obtain the **PESQ Tools GUI** installation.

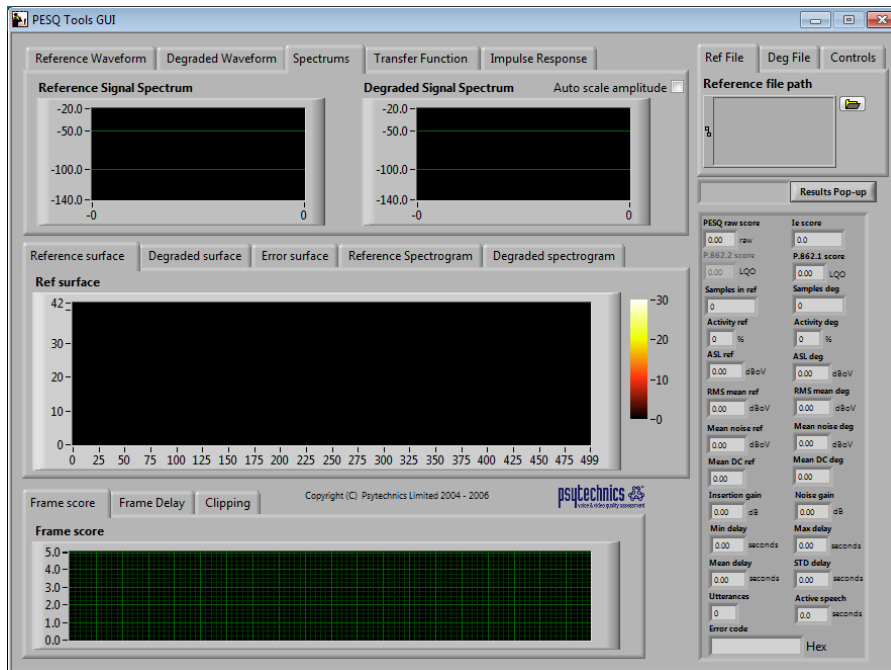



Figure 8-25 - PESQ Tools GUI

The PESQ algorithm calculates MOS by comparing audio samples degraded by the communication channel to the original source sample. Therefore, the PESQ Tools GUI requires both the original and the degraded samples as inputs. To analyze a degraded sample:

1. Open the Reference File

- From the **Ref File** tab of the control panel, click on the **Open**  button in the **Reference file path** area.
- The standard audio scoring files are stored in the **C:\Program Files\Spirent Communications\Nomad\Audio Files** directory. Select **narr_usasts_107dB.wav** for narrowband handsets (8 kHz) or **wide_usasts_107dB.wav** for wideband handsets (16 kHz).
- The **Hardware Sample Rate** (8 kHz or 16 kHz) can be confirmed on the Nomad **Settings → Voice Quality** tab.

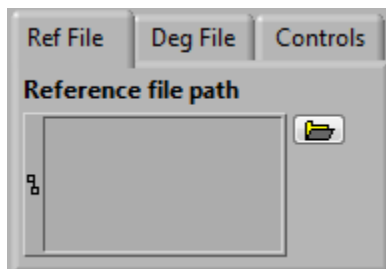



Figure 8-26 - Ref File Tab

2. Open the Degraded File

- From the **Deg File** tab of the control panel, click on the **Open**  button in the **Degraded file path** area.
- Browse to the storage location for the degraded log file and open the file. Degraded session log files are stored in the **Log File Storage Location** specified in the **Start Logging Session Wizard** (see [Section 6.4](#)).

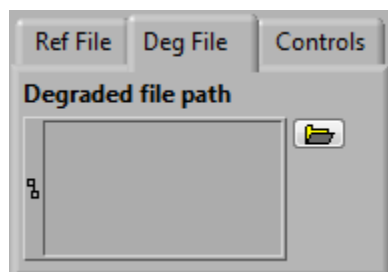


Figure 8-27 - Deg File Tab

3. Run the Analysis

- On the **Controls** tab of the PESQ Tools GUI control panel click **Run**  to run the analysis.

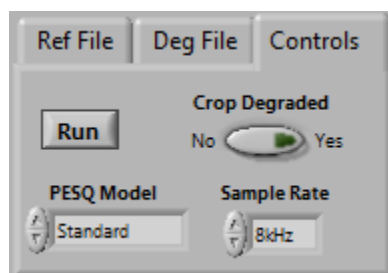


Figure 8-28 - Controls Tab

The **PESQ Tools GUI** can assist in the identification of issues that contribute to low MOS such as background noise and speech clipping. The case study in [Appendix D](#) illustrates how the PESQ Tools GUI can be used to identify these types of issues in a test file exhibiting low MOS results.

8.8 Troubleshooting Incomplete Data

On occasion, Nomad may be unsuccessful in merging the uplink and downlink data from a test session into a unified log file for report generation. Such files will appear on the **Data** → **Incomplete** tab at the conclusion of a test (successfully merged files appear on the **Data** → **Complete** tab).

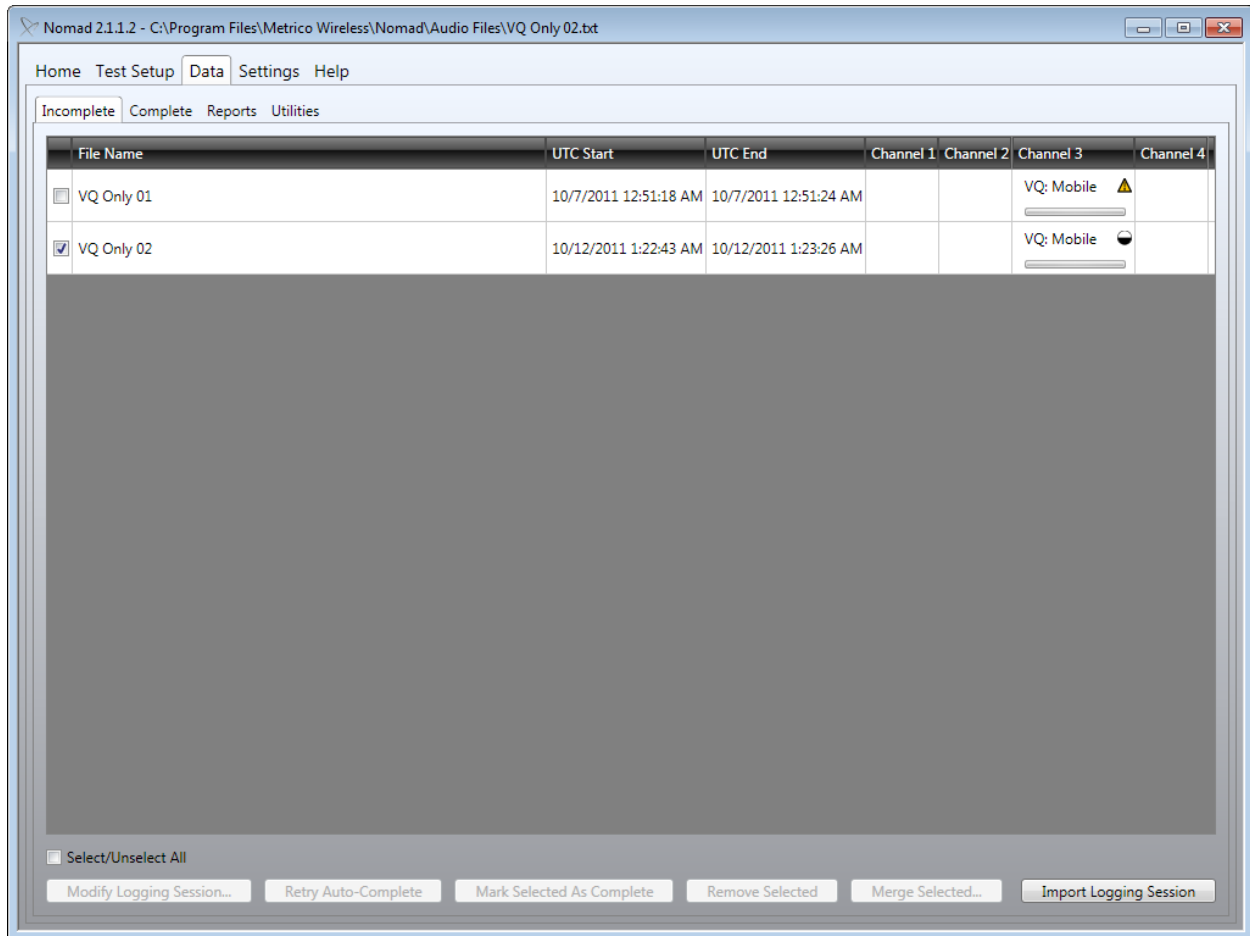




Figure 8-29 - Incomplete Session Files

Files on the **Incomplete** tab contain an icon signifying each problematic channel:

- The **half-circle** icon indicates that Nomad does not have access to all of the data required to merge this file. This might appear if no calls were started for a channel during a test. This might also appear in the case of a **Remote Unit** test where Nomad can access the locally collected data but not the remotely collected data.
- The **yellow triangle** icon indicates that an error has occurred during data collection preventing Nomad from merging the uplink and downlink data associated with this test case. The most common reason for this error is lack of internet connectivity at merge time. Another likely cause is the incorrect entry of the **Phone Number Settings** in the **Session** dialog on the **Test Setup Tab** (see [Section 5.2.2](#)).

Nomad provides several options to modify an incomplete logging session to render it suitable for report generation. Click on the  or  indicator icon to invoke the **Modify Incomplete Logging Session** dialog.

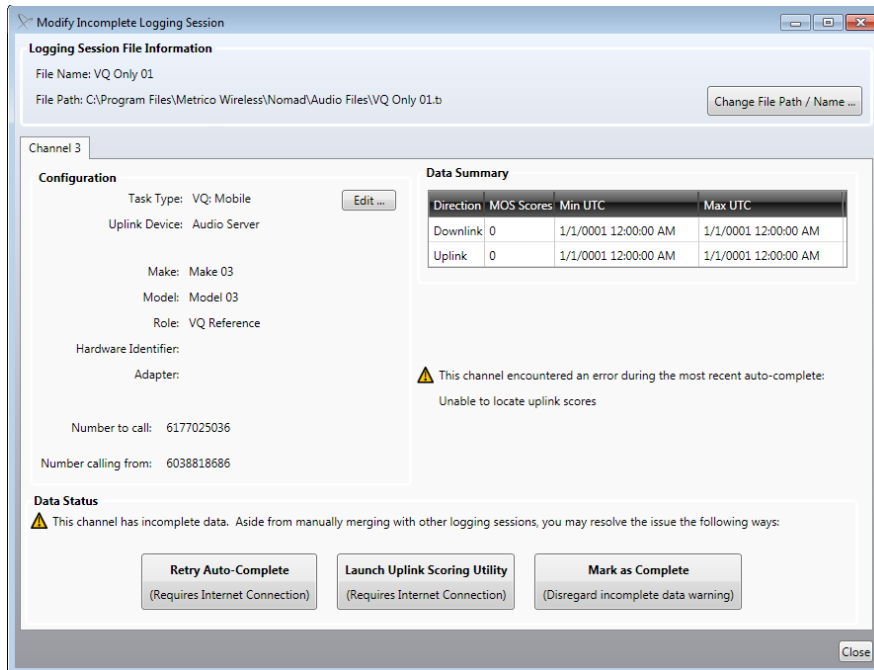




Figure 8-30 - Modify Incomplete Logging Session Dialog

To troubleshoot issues signified by the **yellow triangle**  :

- If lack of internet connectivity is believed to be the reason for the  error, re-establish the internet connection and then use the **Retry Auto-Complete** button to merge the data and move to the **Complete** tab.
- If the  icon indicates **Unable to download uplink scores**, the **Phone Number Settings** for the session are likely incorrect. In this case, select the **Edit** button to **Edit Channel Configuration**. Enter the correct values for **Number to call** and **Number calling from** and then **Close** the dialog. Click **Retry Auto-Complete** to merge the data.

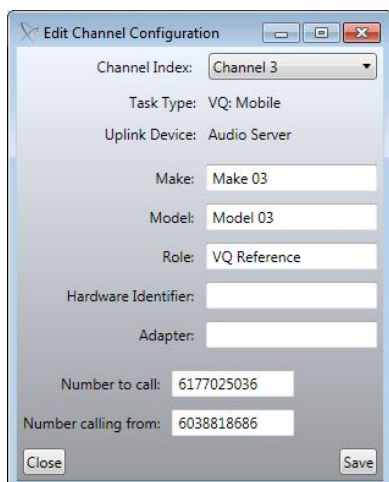


Figure 8-31 - Edit Channel Configuration Dialog

To troubleshoot other incomplete data issues:

- Data collected on a Remote Unit must be copied to the local machine for merging and report generation. Once these files are available locally:
 - Use the **Import Logging Session** button to display the data on the **Incomplete** tab.
 - Select both the local and remote data and choose **Merge Selected**.
 - The merged data will appear on the **Complete** tab and the report may be generated as described in [Section 8.1](#).
- Some files that are unable to be merged automatically can still be merged using the **Uplink Scoring Utility**. See [Section 8.9](#) for more information about using the **Uplink Scoring Utility**.
- If you believe that a channel has been flagged as incomplete in error, use the **Mark As Complete** option to disregard the incomplete data warning. Any report created using this button will be missing data. In this case, Voice Quality tests will be missing uplink scores or CDR data, while Mobile Terminated Call Performance tasks will be missing call server results. The **Mark As Complete** option should only be used if downlink data will be sufficient for analysis.

The **Retry Auto-Complete** and **Mark Selected As Complete** options are also available at the bottom of the **Data → Incomplete** tab. In general, incomplete data should be fixed before generating reports to ensure the integrity of the data.

8.9 Offline Scoring (Voice Quality Testing)

The ability to generate MOS outputs for .WAV files outside of an active test session is called **Offline Scoring**. Use **Offline Scoring** to retrieve .WAV files stored on the Audio Server when uplink results are not available during data collection and data must be retrieved after test completion. Uplink .WAV files are stored on the Audio Server for three weeks after collection.

To perform **Offline Scoring** for files located on the Audio Server, start by accessing the **Uplink Scoring Utility**:

- From the **Data** → **Utilities** tab, highlight **Uplink Offline Scoring** and click **Launch Utility**.
- Alternatively, access the **Uplink Scoring Utility** from the **Modify Incomplete Logging Session** dialog on the **Data** → **Incomplete** tab.

On the **Settings** screen of the **Uplink Scoring Utility**:

- Confirm that the Audio Server settings are correct using the **Validate Settings** button.
- Select the **Sample Rate** as either **8 kHz** (narrowband) or **16 kHz** (wideband).
- Select the **Scoring Model** as either **PESQ** or **POLQA**.
- Select the appropriate narrowband or wideband reference audio file from the Audio Files directory within the Nomad installation (likely **C:\Program Files\Spirent Communications\Nomad\Audio Files**)
- Select a **Logging Session** option:
 - **Create a new logging session using offline scoring**
 - This option creates a local uplink file based on data stored on the Audio Server for the selected call session and date / time range.
 - The uplink .WAV files are also downloaded to the local machine.
 - This option is to be used when the downlink file is not readily available, but the collection times are known.
 - This option might be selected when testing has been performed in the field, but an office-based engineer requires access to the uplink results and / or .WAV files.
 - See [Section 8.9.1](#) to create a merged uplink file using this method.
 - **Retrieve complementary uplink data for an existing Logging Session**
 - This option creates a local merged uplink-downlink file based on data stored on the Audio server which corresponds to a locally stored downlink file.
 - The uplink .WAV files are also downloaded to the local machine.
 - This option is to be used when the downlink file corresponding to the desired uplink file is readily available.
 - This option might be selected when local access to the .WAV files is required.
 - See [Section 8.9.2](#) to create a merged uplink file using this method.
- Click **Next** to continue.

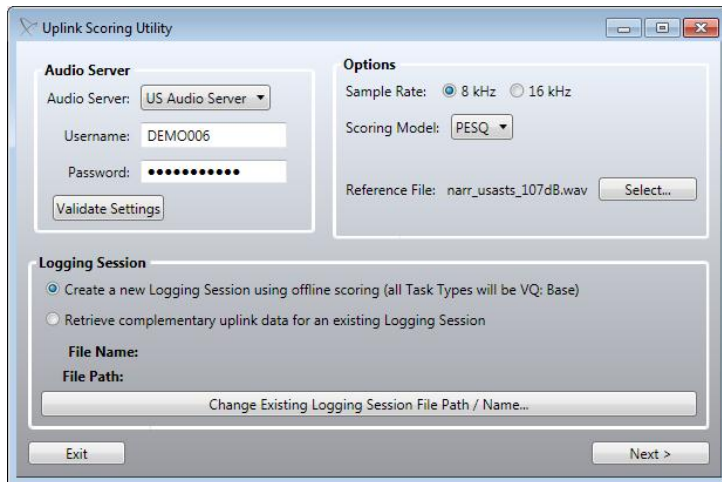


Figure 8-32 - Uplink Scoring Utility Settings Screen

8.9.1 Creating a New Logging Session Using Offline Scoring

On the **Session Selection Screen** of the **Uplink Scoring Utility**:

- Select the start and end date/time values in UTC. These can be found by opening the corresponding downlink log file and noting the timestamps of the first and last entries.
- **Enable** the channels for which to retrieve data.
- Specify the session(s) for which to retrieve the audio files. Each handset can be identified using the **{4 Digit DNIS}-{10 Digit ANI}-{MMDD}** convention with:
 - **{4 Digit DNIS}** – Last four digits of the Audio Server phone number called by the mobile.
 - **{10 Digit ANI}** – The phone number of the mobile phone being tested.
 - **{MMDD}** – The two digit month and two digit date.
- Click **Begin Scoring**.
- When the Offline Scoring process is complete, access the output file from the specified location. The file will also appear on the **Incomplete** tab where it can be marked as **Complete** for report generation.

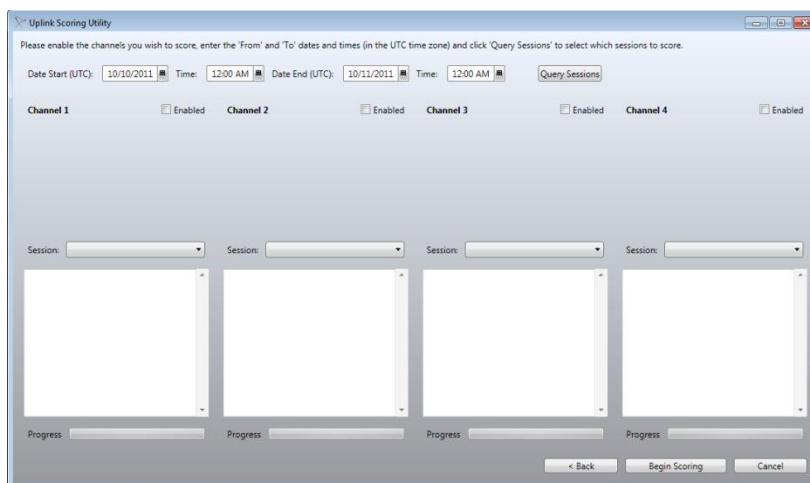


Figure 8-33 – Creating a New Logging Session Using Offline Scoring

8.9.2 Retrieving Complementary Uplink Data for an Existing Logging Session

On the **Session Selection Screen** of the **Uplink Scoring Utility**:

- **Enable** the channels for which to retrieve data.
- The details of the downlink voice quality task will appear for each channel, including start and end time of data collection.
- Specify the session(s) for which to retrieve the audio files. Each handset can be identified using the **{4 Digit DNIS}-{10 Digit ANI}-{MMDD}** convention with:
 - **{4 Digit DNIS}** – Last four digits of the Audio Server phone number called by the mobile.
 - **{10 Digit ANI}** – The phone number of the mobile phone being tested.
 - **{MMDD}** – The two digit month and two digit date.
- Click **Begin Scoring**.
- When the Offline Scoring process is complete, access the output file from the specified location. The file will also appear on the **Incomplete** tab where it can be marked as **Complete** for report generation.

The screenshot shows the 'Uplink Scoring Utility' window. At the top, a message states: 'The following data was detected in the Logging Session file. Please verify the corresponding uplink sessions are selected and click 'Begin Scoring'.' Below this, there are four columns representing different channels, each with a task description, dialing information, and time ranges. Channel 1 and 2 are disabled, while Channel 3 and 4 are enabled. Each channel has a 'Session' dropdown menu and a 'Progress' bar. At the bottom, there are buttons for '< Back', 'Begin Scoring', and 'Cancel'.

Channel 1	Channel 2	Channel 3	Channel 4
<input type="checkbox"/> Enabled	<input type="checkbox"/> Enabled	<input checked="" type="checkbox"/> Enabled	<input checked="" type="checkbox"/> Enabled
Task: CP: Mobile Originate	Task: CP: Mobile Terminate	Task: VQ: Mobile	Task: VQ: Mobile
Number To Dial:	Number To Dial:	Number To Dial: 6177025036	Number To Dial: 6177025036
Number Dialing From:	Number Dialing From:	Number Dialing From: 6038818686	Number Dialing From: 4438786148
Start Time (UTC): 1/1/0001 12:00:00 AM	Start Time (UTC): 1/1/0001 12:00:00 AM	Start Time (UTC): 10/6/2011 6:32:10 PM	Start Time (UTC): 10/6/2011 6:32:10 PM
End Time (UTC): 1/1/0001 12:00:00 AM	End Time (UTC): 1/1/0001 12:00:00 AM	End Time (UTC): 10/6/2011 6:40:04 PM	End Time (UTC): 10/6/2011 6:40:07 PM
Session: [Dropdown]	Session: [Dropdown]	Session: [Dropdown]	Session: [Dropdown]
Progress [Bar]	Progress [Bar]	Progress [Bar]	Progress [Bar]

Figure 8-34 - Retrieving Complementary Uplink Data for an Existing Logging Session

8.10 Scoring PESQ and POLQA

It may be desirable to score Voice Quality test results using both the PESQ and POLQA scoring models. On the first pass, the data will always be scored using the **ScoringModel** specified in the test definition. These options exist to score the same data using the other **ScoringModel**:

- [Re-Score Files](#)
- [Batch Scoring](#)
- [Uplink Offline Scoring](#)

8.10.1 Re-Score Files

The **Re-score Files** option will re-process any file using the **ScoringModel** (PESQ or POLQA) not previously used. To re-score a file:

- On the **Data → Complete** tab, right-click on the file to re-score and select **Re-score Files**. Click **Next** to accept the files to re-score.

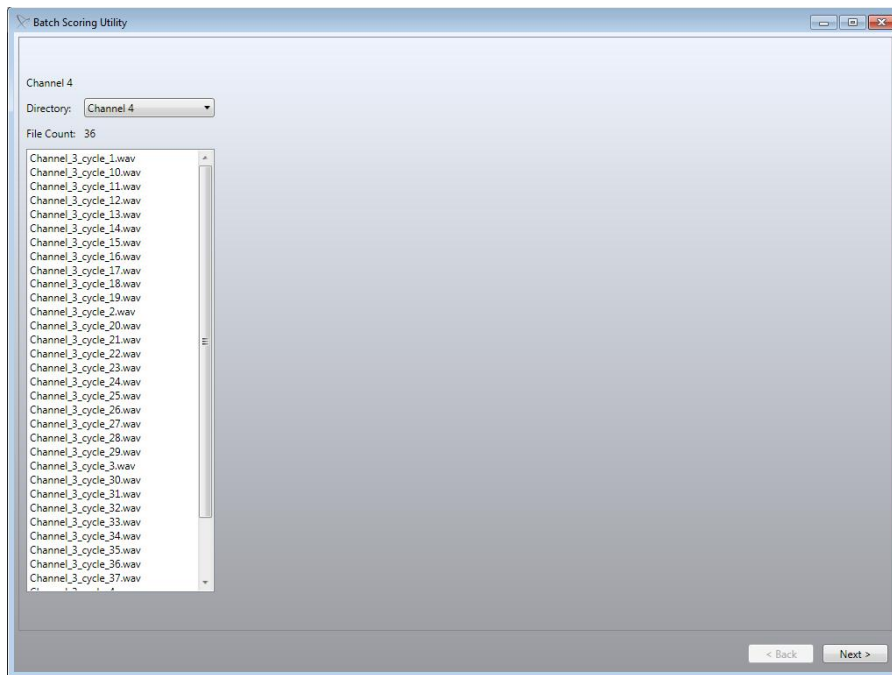


Figure 8-35 - Files to Re-score

- Click **Start Scoring** to begin processing the data.

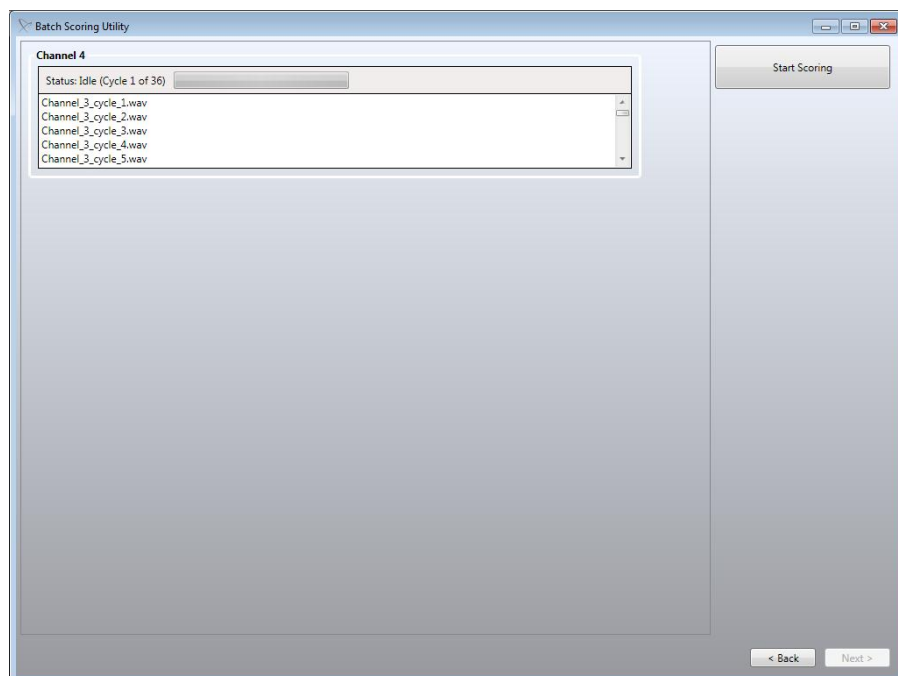


Figure 8-36 - Start Re-scoring

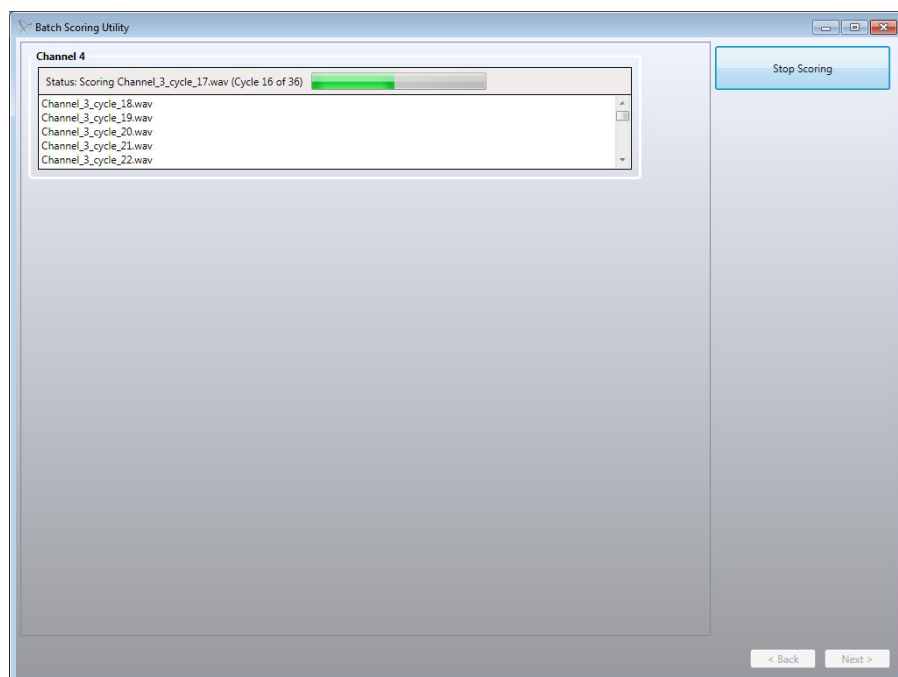


Figure 8-37 - Re-scoring in Progress

- Find the re-scored file on the **Data → Incomplete** tab. The file name will contain the word “rescored” for identification purposes.
- Use the **Retry Auto-Complete** button to move the re-scored file to the **Complete** tab.
- Generate a report from the re-scored file.

Nomad automatically detects and uses the **Scoring Model** not used to score the original file. For example, if POLQA was used to score the original file, PESQ will be used when re-scoring. The **Scoring Algorithm** in use can be verified on the **Voice Quality Summary** tab of the output report.

Note: Although the PESQ and POLQA results for the same file cannot be output to the same report, two output reports may be viewed side-by-side (or data copied from one to another) in order to compare results.

8.10.2 Batch Scoring

Nomad provides a **Batch Scoring Utility** to score multiple .WAV files using PESQ, POLQA or both. The output of this utility is a delimited text file that may be viewed in raw form, opened in Excel or parsed with a script. The **Batch Scoring Utility** may be used to score previously unprocessed files or for re-scoring.

Note: The Spirent ME hardware unit must be attached in order for the **POLQA** and **PESQ & POLQA** scoring options to be available in the **Batch Scoring Utility**.

To batch process with this utility:

- On the **Nomad Data → Utilities** tab, select **Batch Scoring** and click the **Launch Utility** button.
- Select the appropriate narrowband or wideband reference audio file from the Audio Files directory within the Nomad installation (likely **C:\Program Files\Spirent Communications\Nomad\Audio Files**).
- Select the **Scoring Algorithm** as **PESQ**, **POLQA** or **PESQ & POLQA**.
- Use the **Add Files** or **Add Directory** button to browse for and open the .WAV files to score.
- Click **Next** to accept the settings and proceed.

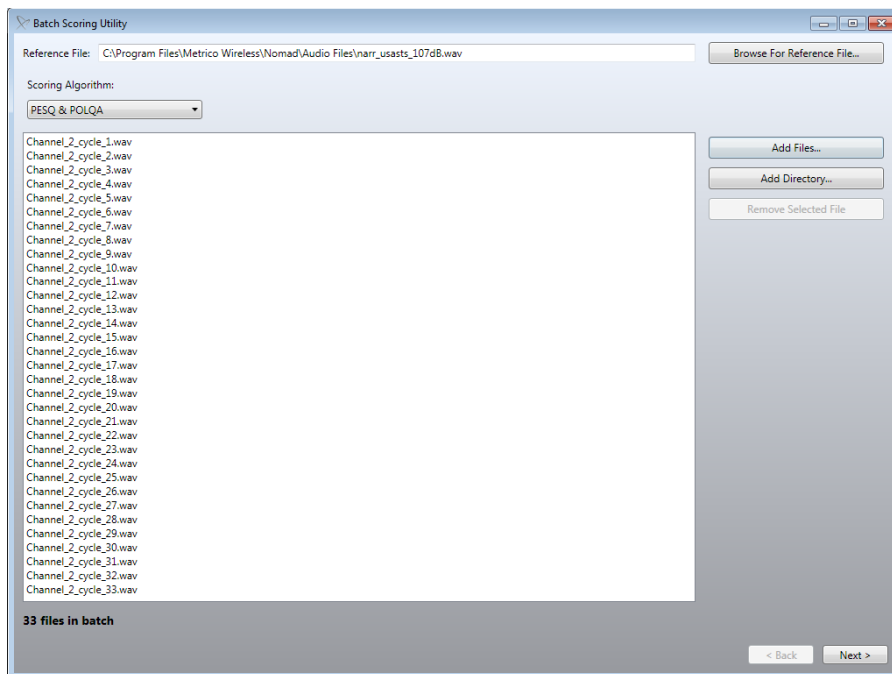


Figure 8-38 - Batch Scoring Configuration

- Click **Start Scoring** to accept the settings and proceed.

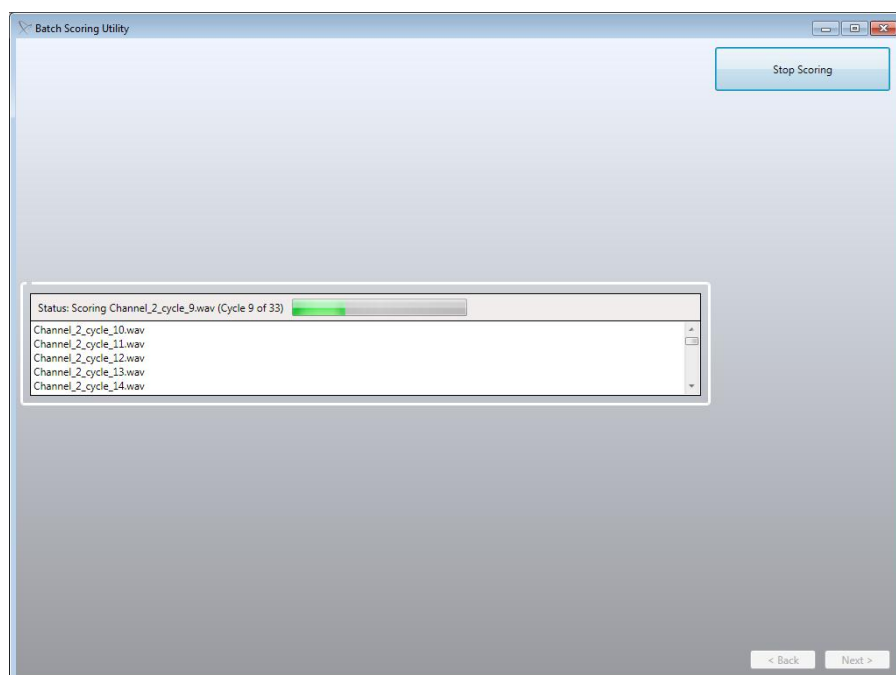


Figure 8-39 - Batch Scoring in Progress

- When scoring is complete, processing and MOS statistics will be presented for the selected scoring algorithm(s).

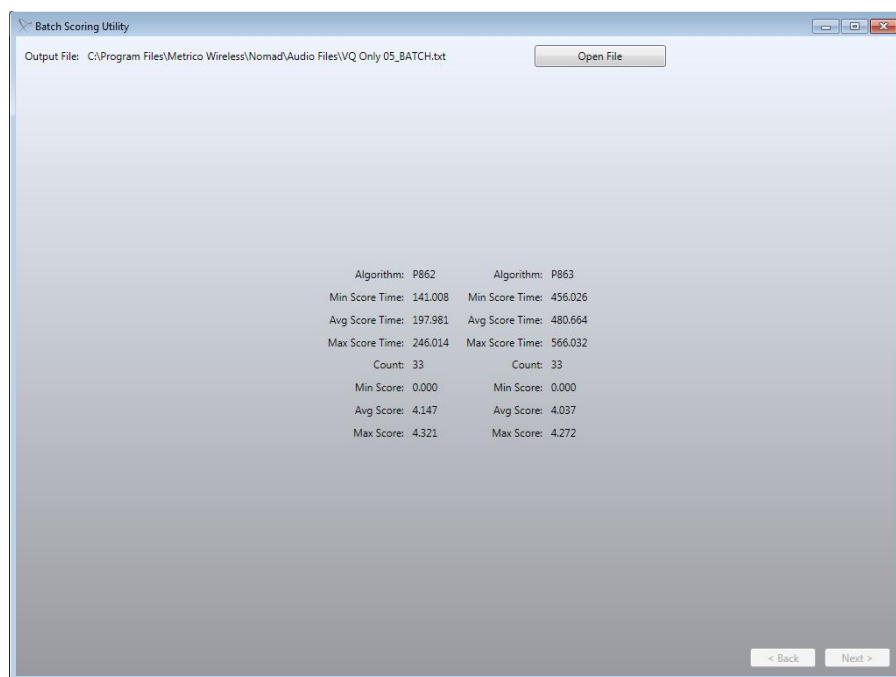


Figure 8-40 - Batch Scoring Complete

Use the **Open File** button to view the processed data. This delimited text file can be analyzed in its raw form, opened in Excel or used as the basis of a custom processing script.

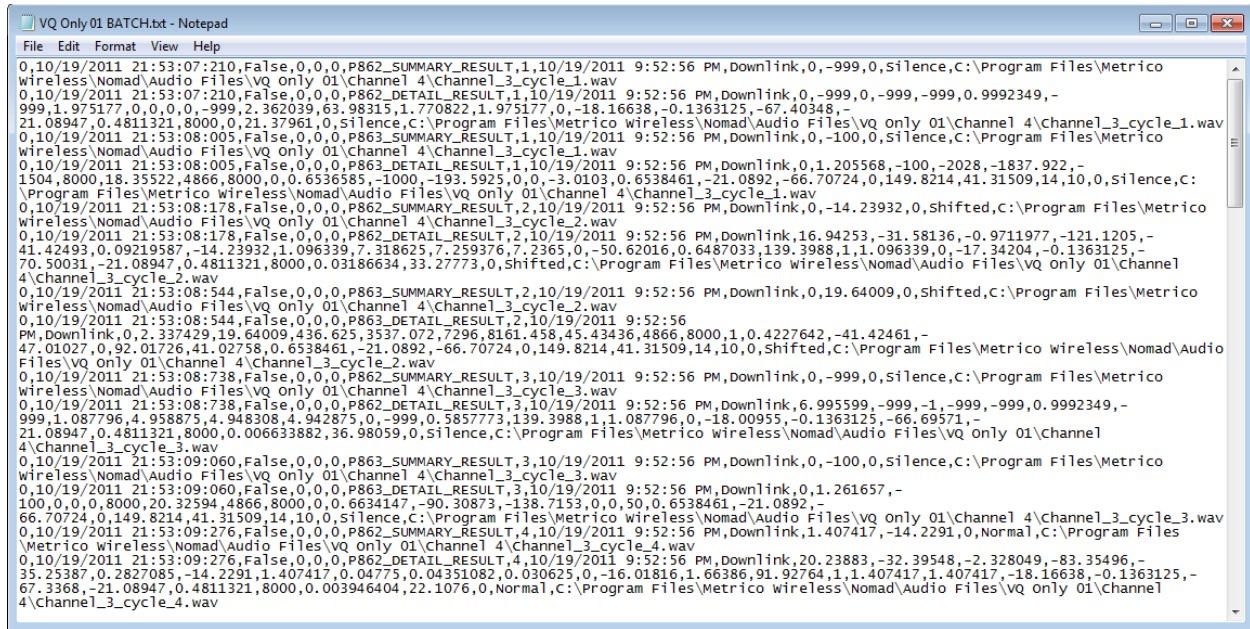


Figure 8-41 - Batch Scoring Output

8.10.3 Offline Scoring

The Nomad **Offline Scoring** utility provides a method of retrieving and scoring uplink .WAV files from the Audio Server outside of an active test session. Files processed using Offline Scoring may be scored using either PESQ or POLQA.

Note: The Spirent ME hardware unit must be attached in order for the POLQA scoring option to be available in the **Offline Scoring Utility**.

Offline scoring can be used to score previously unprocessed files or for re-scoring. Select the **Scoring Model** on the **Uplink Scoring Utility Settings Screen** to choose between PESQ and POLQA.

See [Section 8.9](#) for detailed information about the Uplink Offline Scoring utility.

9 Voice Quality Configuration Options

Nomad provides numerous configuration options for voice quality testing. These options include:

- [Voice Quality Test Calibration](#)
- [Audio Server Testing](#)
- [Mobile-to-Mobile Testing](#)
- [Remote Unit Testing](#)
- [Landline Module Testing](#)
- [Base Station Simulator Testing](#)
- [Head and Torso Simulator Testing](#)
- [Wideband Testing](#)
- [Multi-RAB Testing](#)
- [Voice Delay Testing](#)
- [Adapter Kit](#)

This section contains detailed instructions for each voice quality configuration option.

9.1 Voice Quality Test Calibration

Spirent Communications recommends calibrating the Spirent ME or Spirent HD ME hardware used with the Nomad system prior to testing for the first time to verify proper operation. To calibrate the system:

- Connect the provided **Calibration Cable** between **Channel 1** and **Channel 2** on the Spirent ME unit or between **NB1** and **NB2** (narrowband) on the Spirent HD ME unit or between **HD1** and **HD2** (high definition) on the Spirent HD ME unit.
- On the Nomad **TestSetup** screen, configure **Channel 1** as a **Mobile** task with the following settings:
 - **Session** → **Uplink Device**: Base task on channel 2
 - **Channel Settings** → **Audio interface for this channel**: Analog Interface for Nomad ME Units, Narrowband or High Definition for Nomad HD ME units.
 - **Channel Settings** → **Input Level**: 225
 - **Channel Settings** → **Output Level**: 180
 - **Channel Settings** → **Microphone Detect Mode**: Confirm that this option is unchecked
- On the Nomad Test Setup screen, configure **Channel 2** as a **Base** task with the following settings:
 - **Session** → **Downlink Device**: Base task on channel 1
 - **Channel Settings** → **Audio interface for this channel**: Analog Interface for Nomad ME Units, Narrowband or High Definition for Nomad HD ME units.
 - **Channel Settings** → **Input Level**: 225
 - **Channel Settings** → **Output Level**: 180
 - **Channel Settings** → **Microphone Detect Mode**: Confirm that this option is unchecked
- Start a new test. The resulting **MOS** values for **Channel 1** and **Channel 2** should be **4.542** or higher, representing perfect audio. If this is the case, the unit has passed.
- Connect the **Calibration Cable** between **Channel 3** and **Channel 4** on the Spirent ME unit and repeat the test.

In the formatted Nomad output report generated with calibration test data, find results for audio received at **Channel 1** in the **Channel 1 – DL** area. Find results for audio received at **Channel 2** in the **Channel 1 – UL** area.



Figure 9-1 – Hardware Configuration for Voice Quality Test Calibration on a Nomad ME unit

9.2 Audio Server Testing

Spirent Communications provides access to a centralized call server that sources downlink data and records uplink data in the audio server testing configuration. The mobile handset will source speech while the audio server will record and score the uplink speech sample for ten seconds. In the next ten second cycle, the audio server will source speech while the mobile handset records and scores the downlink speech sample.

To perform Audio Server testing:

- Connect the test handset to any active channel on the Spirent ME hardware unit via audio cable or Bluetooth.
- On the Nomad **TestSetup** screen, configure that channel as a **Mobile** task with the following settings:
 - **Session → Uplink Device:** Audio Server
 - **Channel Settings → Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD), High Definition (ME HD) or Bluetooth Interface as desired. Note that a maximum of two Bluetooth devices is permitted for Voice Quality testing at one time.
- If the test mobile is connected via analog audio cable, volume settings may be optimized using **Auto-Level Assist**.
- Click the **Start Logging Session** button and proceed through the **Start Logging Session Wizard**.
- At the conclusion of the **Start Logging Session Wizard**, Nomad will automatically place test calls for devices which are connected via Bluetooth and which have been configured for auto-dial on the **Settings → Voice Quality** tab. All other calls must be manually placed to the Audio Server.
- The test sequence starts with the mobile handset sourcing data to the Audio Server.
- In the second half of the cycle, the Audio Server will source data to the mobile handset. Downlink data collected at the handset is displayed in the **Voice Quality Task Status Window** during the following cycle.



Figure 9-2 - Voice Quality Task Status Window

- During testing, adjust the downlink volume using the **Settings → Levels** dialog such that the **Insertion Gain** (PESQ) or **Attenuation** (POLQA) falls as close to 0 as possible. The **Input** slider should sit within the **Normal Operating Range** values displayed.
- End the test when desired.

Test results can be found on the **Voice Quality Summary** tab of the output report.

9.3 Mobile-to-Mobile Testing

Nomad provides the option for Mobile-to-Mobile testing. One handset will source speech while the other will record speech for ten seconds. The process will alternate in the next ten second cycle. Both the sourcing and recording is handled by a single Nomad installation.

To perform Mobile-to-Mobile testing:

- Connect one handset to **Channel 1** of the Spirent ME hardware unit via audio cable. Connect the second handset to **Channel 2**.

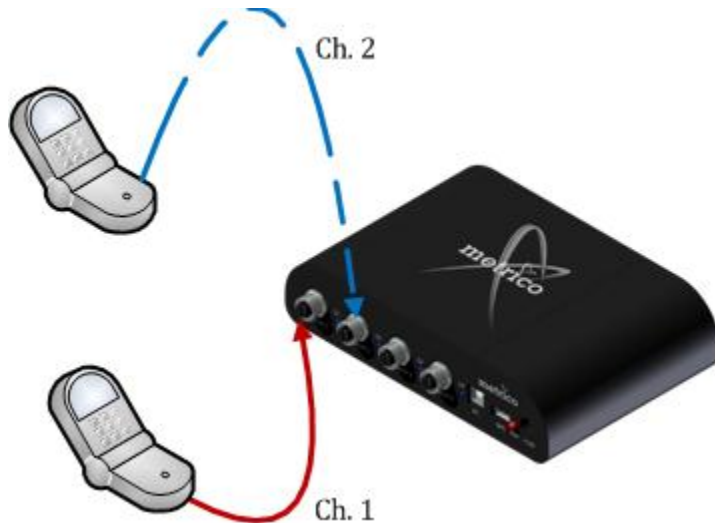


Figure 9-3 - Mobile-to-Mobile Hardware Configuration

- On the Nomad **TestSetup** screen, configure **Channel 1** as a **Mobile** task with the following settings:
 - **Session** → **Uplink Device**: Base task on channel 2
 - **Channel Settings** → **Audio interface for this channel**: Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
- On the Nomad **TestSetup** screen, configure **Channel 2** as a **Base** task with the following settings:
 - **Session** → **Downlink Device**: Mobile task on channel 1
 - **Channel Settings** → **Audio interface for this channel**: Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
- Confirm that Channel 1 and Channel 2 use the same **Scoring Model**. Both channels must be set for either PESQ or POLQA in the **Session** dialog.
- Place a call from **Handset 1** to **Handset 2**. The incoming call must be manually answered.
- Start a new test.
- The test sequence starts with **Handset 1** sourcing data to **Handset 2**. Data collected at **Handset 2** will be replayed in the **Channel 2** area of the Nomad interface.
- In the next cycle, **Handset 2** will source data to **Handset 1**. Data collected at **Handset 1** will be replayed in the **Channel 1** area of the Nomad interface. This pattern continues throughout the duration of the test.

- During testing, adjust volume using the **Settings** → **Levels** dialog such that the **Ins Gain** (PESQ) or **Attenuation** (POLQA) reading for each channel falls as close to 0 as possible. The **Input** and **Output** sliders should sit within the **Normal Operating Range** values displayed.
- End the test when desired.

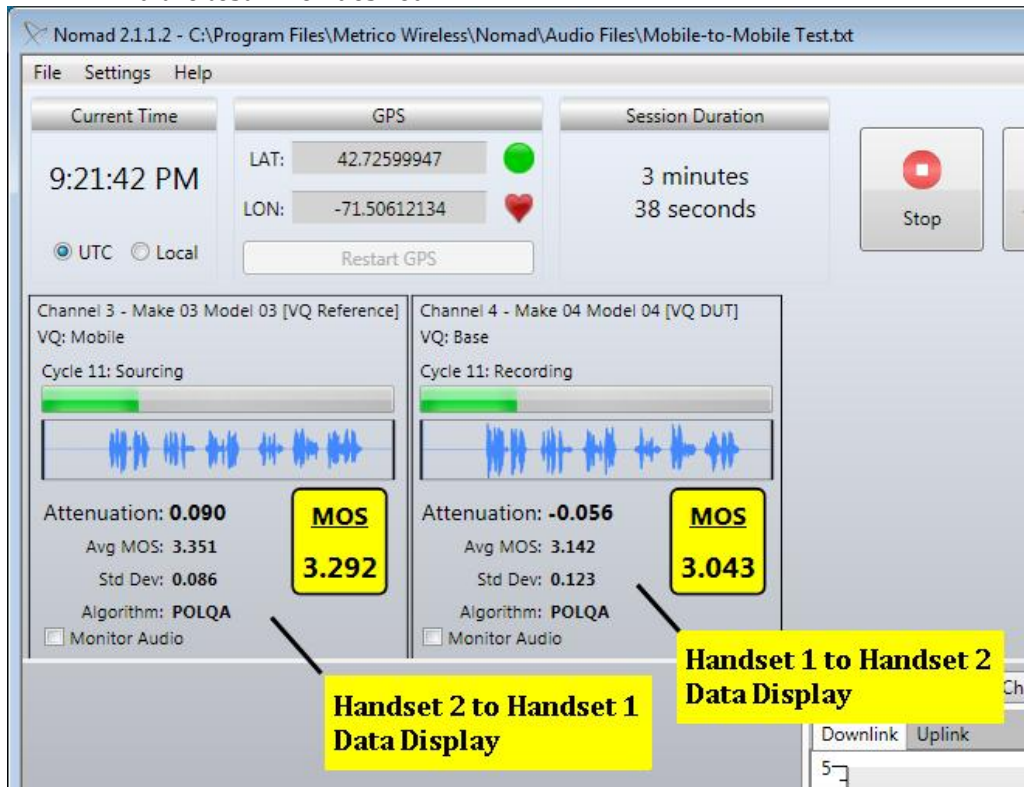


Figure 9-4 - Mobile-to-Mobile Testing

Assuming all four channels are available for testing, a second Mobile-to-Mobile test may be performed simultaneously on **Channel 3** and **Channel 4**. Configure this test following the same instructions as above.

In the Nomad output report generated with Mobile-to-Mobile test data, find results for audio received at **Channel 1** in the **Channel 1 – DL** area. Find results for audio received at **Channel 2** in the **Channel 1 – UL** area.

9.4 Remote Unit Testing

Nomad provides the option for Remote Unit testing. In this configuration, a handset connected to the local Spirent ME hardware unit sources audio to and receives audio from a handset connected to a second hardware unit. In many cases, the second hardware unit is located remotely (i.e. in another office or city). One handset will source speech while the other will record speech for ten seconds. The process will alternate in the next ten second cycle.

To perform Remote Unit hardware testing:

- Connect one handset to **Channel 1 (ME), NB1 (ME HD) or HD1 (ME HD)** on the local Spirent ME or HD ME hardware unit.
- Connect the second to **Channel 1 (ME), NB1 (ME HD) or HD1 (ME HD)** on the second Spirent ME or HD ME hardware unit.
- If the second hardware unit is located remotely, ask a colleague for assistance in setting up that unit.



Figure 9-5 - Remote Unit Hardware Configuration for a Spirent ME unit

- In the local Nomad software, configure **Channel 1** as a **Mobile** task with the following setting:
 - **Session** → **Uplink Device**: Base task on remote unit
- In the remotely located Nomad software, configure **Channel 1** as a **Base** task with the following setting:
 - **Session** → **Downlink Device**: Mobile task on remote unit
- Confirm that both test channels use the same **Scoring Model**. Both channels must be set for either PESQ or POLQA in the **Session** dialog.
- If testing is performed using Spirent HD ME hardware, make sure the proper Audio interface (High definition or Narrowband) is selected.
- Place a call from **Handset 1** to **Handset 2**. The incoming call must be manually answered.
- Start a new test.
- The test sequence starts with the local handset sourcing data to the remote handset. Data collected at the remote handset will be displayed in **Channel 1** of the remote Nomad installation.
- In the next cycle, the remote handset will source data to the local handset. Data collected at the local handset will be displayed in **Channel 1** of the local Nomad installation.
- During testing, adjust volume using the **Settings** → **Levels** dialog such that the **Ins Gain** (PESQ) or **Attenuation** (POLQA) reading for each channel falls as close to 0 as possible. The **Input** and **Output** sliders should sit within the **Normal Operating Range** values displayed.

- End the test when desired.

Assuming all four channels are available for testing, up to four Remote Unit test calls may be placed simultaneously. Spirent Communications recommends aligning calling handsets on the local unit with the receiving handsets on the remote unit. For example, **Handset 1** on the local unit should call **Handset 1** on the remote unit; **Handset 2** on the local unit should call **Handset 2** on the remote unit, etc.

To merge the local and remote data into a single file for report generation:

- Obtain the remotely collected log file via email or other file transfer method.
- Because Nomad will have access to only the locally collected data (not the data collected remotely), the locally collected file will appear on the **Data** → **Incomplete** tab after collection is stopped.
- Use the **Import Logging Session** button to find and open the remotely collected log file.
- On the **Data** → **Incomplete** tab, select both the locally collected file and the remotely collected file.
- Click the **Merge Selected** button to merge the two files into one file that will appear on the **Data** → **Complete** tab and which can be used to generate a formatted output report.

In the formatted output report generated with Remote Unit test data, find results for locally received audio in the **Channel 1 – DL** area. Find results for remotely received audio in the **Channel 1 – UL** area.

9.5 Landline Module Testing

The Nomad Landline Module provides an additional option for voice quality testing without needing the Audio Server to handset uplink data collection and downlink audio sourcing. In the Landline Module configuration, the mobile end consists of the standard test handset and Spirent ME unit connected to a laptop which handles downlink data collection and uplink audio sourcing. The landline end consists of the Nomad Landline Module hardware with analog phone connections as the communications links and a computer for handling uplink data collection and downlink audio sourcing.

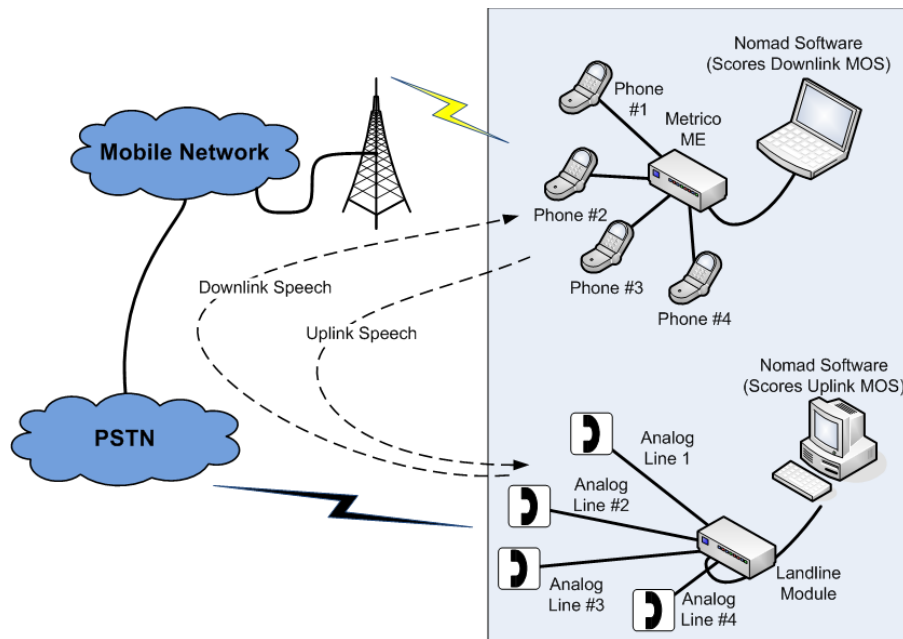


Figure 9-6 - System Configuration for Landline Module Testing

The Nomad setup and configuration for both the mobile and landline end are identical to the Remote Unit testing configuration described in [Section 9.3](#). The only difference is that each test call is made from the handset at the mobile end to the corresponding analog phone line on the Landline Module. For the best results, Spirent Communications recommends dialing **Line 1** using the handset on **Channel 1, Line 2** with **Channel 2**, etc. Assuming all four channels are available for testing, up to four Landline Module test calls may be placed simultaneously.

9.6 Base Station Simulator Testing

The Rohde & Schwarz CMU200 and the Agilent 8690 are two commercial base station simulators commonly used to simulate radio conditions in a test lab. An optional Nomad upgrade provides the cables required to interface to these pieces of equipment for degraded channel, noise cancellation and other test scenarios. This interface allows the test handset to perform both sourcing and recording functions, enabling handset testing without a landline voice server. Please contact your Spirent Communications representative for additional information on this option.

To configure Nomad to work with a base station simulator:

- Load the desired test conditions into the simulator. Please see the manufacturer's documentation for simulator configuration details.
- Connect the test handset to **Channel 1** on the Spirent ME hardware unit or **NB1/HB1** on the Spirent HD ME Unit.
- Connect the audio cable provided by Spirent Communications from the base station simulator to **Channel 2** on the Spirent ME hardware unit or **NB2/HB2** on the Spirent HD ME Unit.
-

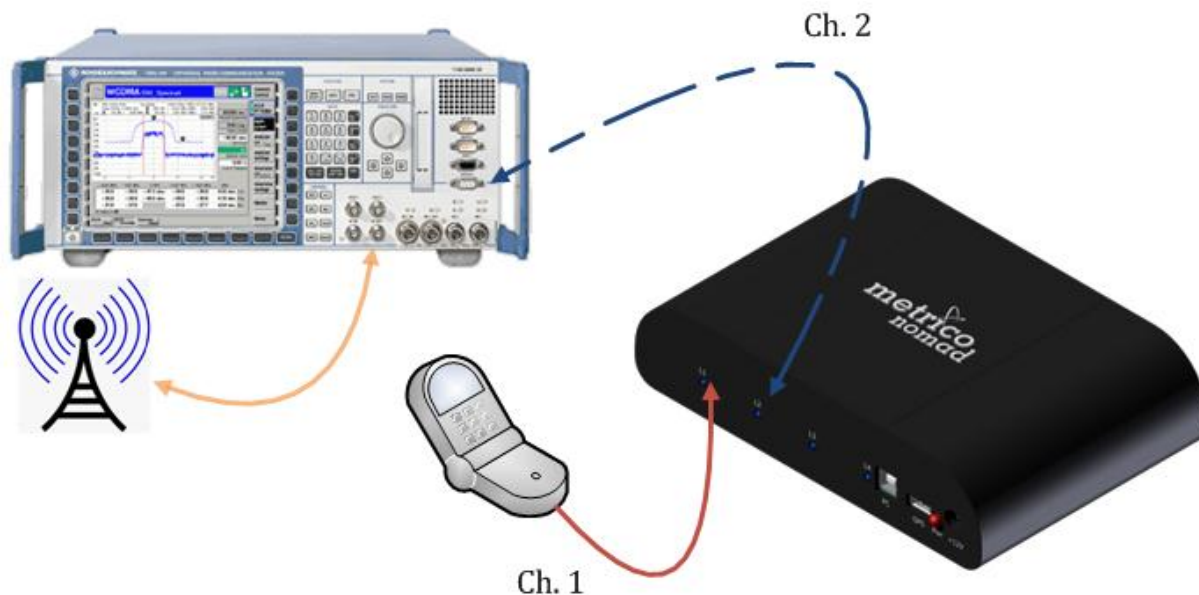


Figure 9-7 - Base Station Simulator Hardware Configuration

- On the Nomad **TestSetup** screen, configure **Channel 1** as a **Mobile** task with the following setting:
 - **Session** → **Uplink Device**: Base task on channel 2
- On the Nomad **TestSetup** screen, configure **Channel 2** as a **Base** task with the following settings:
 - **Session** → **Downlink Device**: Mobile task on channel 1
 - **Channel Settings** → **Input**: 205
 - **Channel Settings** → **Output**: 195
- Confirm that both test channels use the same **ScoringModel**. Both channels must be set for either PESQ or POLQA in the **Session** dialog.

- If testing is performed using Spirent HD ME hardware, make sure the proper Audio interface (High definition or Narrowband) is selected.
- Establish a call between the handset and the base station simulator.
- Start a new test.
- The test sequence starts with the handset sourcing data to the base station simulator. Data collected at the simulator will be replayed in the **Channel 2** area of the Nomad interface.
- In the next cycle, the simulator will source data to the handset. Data collected by the handset will be replayed in the **Channel 1** area of the Nomad interface. This pattern continues throughout the duration of the test.

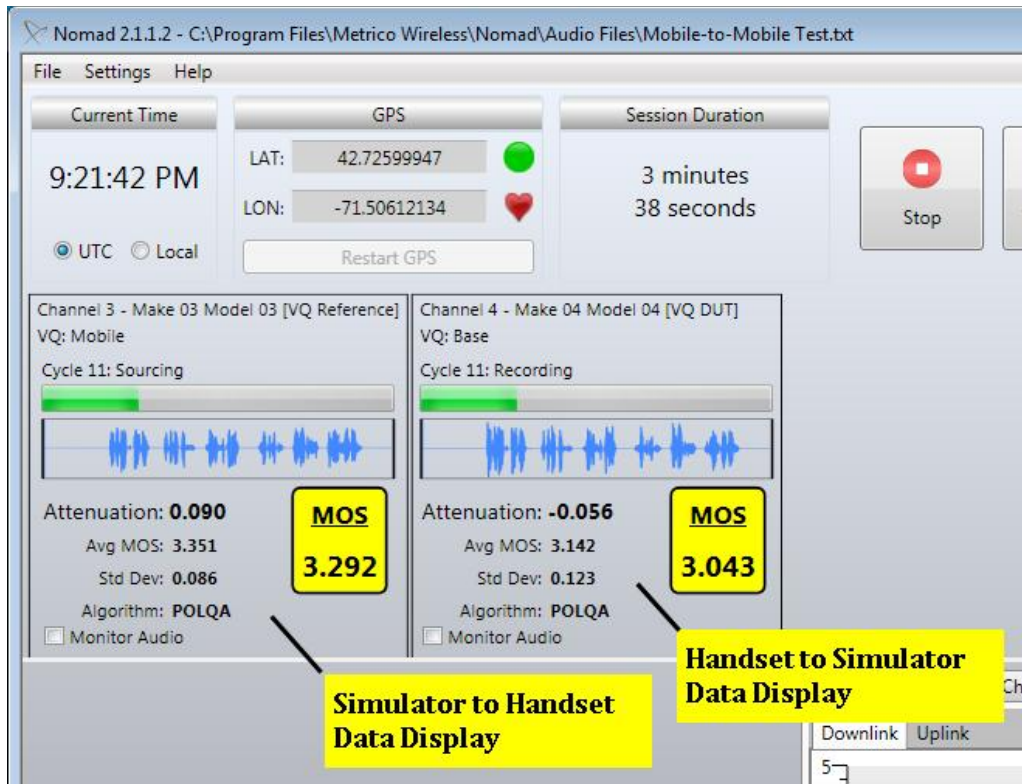


Figure 9-8 - Base Station Simulator Testing

- During testing, adjust **Channel 1** volume using the **Settings** → **Levels** dialog. Adjust the **Channel 1 Input** level for optimal MOS performance of the **Channel 1** (handset) waveform. Adjust the **Channel 1 Output** level for optimal MOS performance of the **Channel 2** (simulator) waveform.
- End the test when desired.

In the formatted Nomad output report generated with base station simulator test data, find results for audio received at the handset in the **Channel 1 – DL** area. Find results for audio received at the simulator in the **Channel 1 – UL** area.

9.7 Head and Torso Simulator

A HATS system may be used in conjunction with the test mobile and base station simulator in Nomad testing to realistically simulate the effect of an adult head and torso on voice quality. The HATS system may be configured with the base station simulator in two different configurations. In each configuration, MOS results at the handset will be displayed in the Nomad **Channel 1** area during testing. Results at the base station simulator will be displayed in the **Channel 2** area. The following sections describe the hardware configuration and volume settings for the HATS configurations. All other test procedures follow the steps described for the base station simulator in [Section 9.6](#).

Note: The **Input** and **Output** settings described in this section represent a general test case that has been performed in the Spirent lab. If you require settings corresponding to specific test cases, please contact your Spirent representative.

9.7.1 HATS Three Channel Configuration

The Spirent ME hardware shall be configured as show below for the HATS three channel configuration:

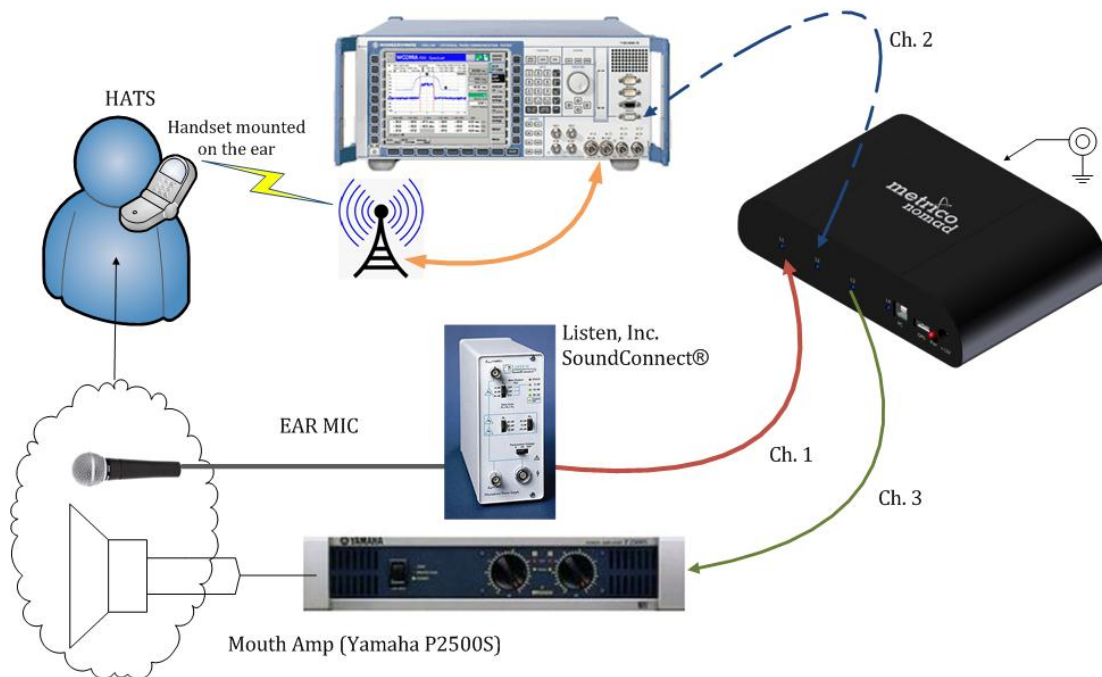


Figure 9-9 - HATS Three Channel Configuration

On the Nomad **TestSetup** tab, configure the channels as follows:

- **Channel 1** – Connects to Ear MIC – “Downlink”
 - **Task Type:** Mobile
 - **Session** → **Uplink Device:** Base task on channel 2
 - **Channel Settings** → **Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
 - **Channel Settings** → **Input:** 210

- **Channel Settings** → **Output:** 100
- **Channel 2** – Connects to base station simulator – “Uplink”
 - **Task Type:** Base
 - **Session** → **Downlink Device:** Mobile task on channel 1
 - **Channel Settings** → **Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
 - **Channel Settings** → **Input:** 180
 - **Channel Settings** → **Output:** 200
- **Channel 3** – Connects to AMP and HATS mouth speaker – “mouth”
 - **Task Type:** Mobile
 - **Session** → **Uplink Device:** Base task on channel 4
 - **Channel Settings** → **Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
 - **Channel Settings** → **Input:** 100
 - **Channel Settings** → **Output:** 200
- **Channel 4** – No hardware connections
 - **Task Type:** Base
 - **Session** → **Downlink Device:** Mobile task on channel 3
 - **Channel Settings** → **Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
 - **Channel Settings** → **Input:** 100
 - **Channel Settings** → **Output:** 100

Finally, make these additional system adjustments:

- **Handset Volume:**
 - One level below max
- **Yamaha Amp Setting:**
 - 20 dB

9.7.2 HATS Two Channel Configuration

The Spirent ME hardware shall be configured as show below for the HATS two channel configuration:

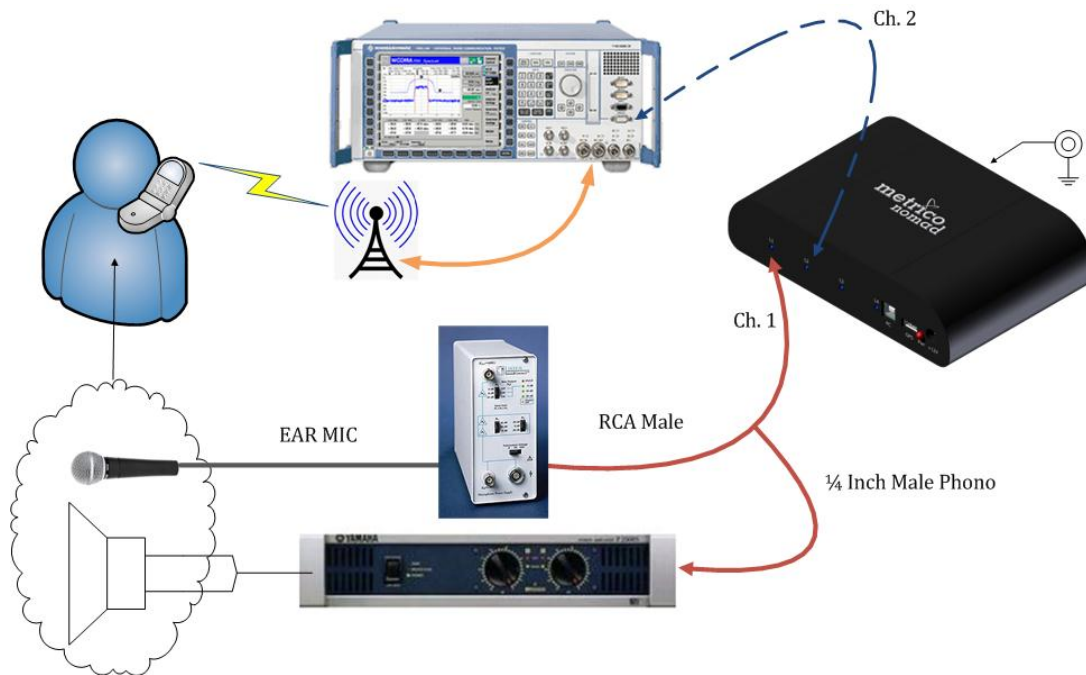


Figure 9-10 - HATS Two Channel Configuration

On the Nomad **TestSetup** tab, configure the channels as follows:

- **Channel 1** – Connects to Ear MIC – “Downlink”
 - **Task Type:** Mobile
 - **Session → Uplink Device:** Base task on channel 2
 - **Channel Settings → Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
 - **Channel Settings → Input:** 210
 - **Channel Settings → Output:** 200
- **Channel 2** – Connects to base station simulator – “Uplink”
 - **Task Type:** Base
 - **Session → Downlink Device:** Mobile task on channel 1
 - **Channel Settings → Audio interface for this channel:** Analog Interface(ME), Narrowband (ME HD) or High Definition (ME HD)
 - **Channel Settings → Input:** 180
 - **Channel Settings → Output:** 200

Finally, make these additional system adjustments:

- **Handset Volume:**
 - One level below max
- **Yamaha Amp Setting:**
 - 20 dB

9.8 Wideband Testing

Nomad contains a wideband speech stimulus designed to exercise various wideband AMR codecs enabled on a wideband AMR device under test. Wideband testing works as follows:

- During the audio quality testing process, Nomad injects a wideband speech stimulus into the communication test path.
- The degraded speech at the receiving end is compared to the original wideband reference speech. The MOS calculation is based on this comparison.

Wideband testing is possible in these test configurations:

- Mobile-to-Mobile testing
- Base Station Simulator testing

Wideband testing is not possible in the Audio Server test configuration due to the narrowband limitation on the PSTN connection to the Audio Server. In general, mobile-to-landline testing is unsupported for wideband due to this limitation.

To perform wideband testing:

- Confirm that all test devices (including test mobiles and base station simulator) and the test network support the wideband codec and have been configured for wideband. Some devices must be manually set to the wideband codec.
- (**Nomad ME**) On the Nomad **Settings** → **Voice Quality** tab, set the **Hardware Sample Rate** to **Wideband (16 kHz)**.
- (**Nomad HD ME**) On the Nomad **Settings** → **Audio interface** tab, select the **High Definition** option
- Configure the Mobile-to-Mobile or Base Station Simulator test as necessary:
 - See [Section 9.3](#) to configure a Mobile-to-Mobile test.
 - See [Section 9.6](#) to configure a Base Station Simulator test. Note that the simulator should initially be configured with the channels simulating ideal yet realistic conditions (i.e. no degradation introduced). A familiar test device with the appropriate adapter should be selected for confirming the initial setup.
- Set the volume of each test handset to one level below the maximum.
- Start a new test.
- Adjust the **Input Levels** and **Output Levels** using the **Settings** → **Levels** controls:
 - For a Mobile-to-Mobile test:
 - Keep the **Output** level at a fixed value for both handsets. Spirent recommends an **Output** level of 140.
 - Adjust the **Input** level for both handsets to obtain an **Ins Gain** reading between -7 and 0 dB, or an **Attenuation** reading between 0 and 7 dB.
 - For a Base Station Simulator test:
 - For Channel 1:
 - Adjust the **Input** level to obtain an **Ins Gain** reading between -7 and 0 dB, or an **Attenuation** reading between 0 and 7 dB.
 - Adjust the **Output** level to obtain an **Ins Gain** reading between -12 and 0 dB, or an **Attenuation** reading between 0 and 12 dB.
 - For Channel 2:
 - Set the **Input** level to 205.

- Set the **Output** level to 195.
- End the test when desired.

9.9 Multi-RAB Testing

The objective of Multi-RAB testing with Nomad is to compare the voice quality or call performance of a mobile engaged in data services to a device not transferring data. An Email Campaign may be launched during a Voice Quality or Call Performance task to test Multi-RAB performance. An Email Campaign tests whether e-mail sent to the phone during a call disrupts performance as compared to phones not receiving e-mail.

To configured a Multi-RAB test in Nomad:

- If custom content is desired for the e-mail to be sent to the phone during testing, navigate to **Settings → Email Campaigns**. On this tab, check **Override default email content** and enter the **Custom email body content**. If this option is left unchecked, the default content of the system-generated message reads: "This is an auto-generated e-mail from Spirent Communications, Inc."

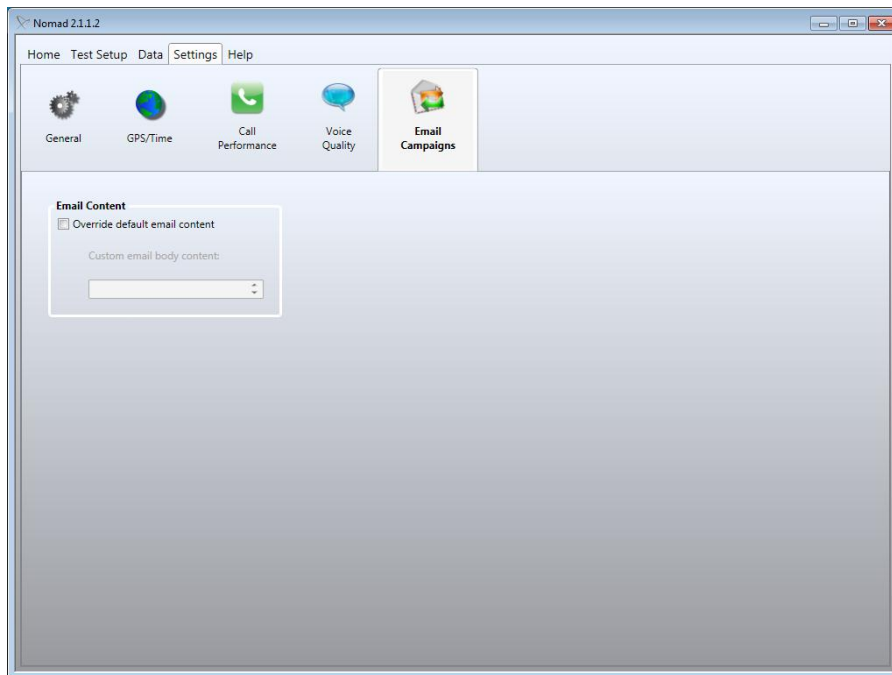


Figure 9-11 - Email Campaign Settings

- On the **Test Setup** tab, configure two Voice Quality or Call Performance tasks as normal.
- Leave one mobile as the "control" with no data traffic.
- Use the **Email Campaign** dialog to configure one mobile to receive periodic e-mails during testing:
 - Select the **Initiate email campaign when logging starts** option.
 - Enter an e-mail address accessible to the test mobile in the **Recipient email address (To:)** field.
 - Enter the **# of emails to send** to the mobile.
 - Enter the **Interval between emails** in seconds.

- If desired, **Generate Test Email** to be sent to the mobile device.
- **Note:** In the event that Nomad becomes inaccessible during an Email Campaign (i.e. due to PC crash, etc.), it is possible to stop e-mail messages from being sent to the handset(s). Simply reply to any message generated by the Email Campaign to stop unwanted messages from being sent to the phone.

Channel 1 -> Mobile -> Email Campaign

Help

An Email Campaign may be launched during a Voice Quality or Call Performance task to test Multi-RAB performance. An Email Campaign tests whether email sent to the phone during a call disrupts performance as compared to phones not receiving email.

- **Initiate email campaign when logging starts**
Select to enable an email campaign.
- **Recipient email address (To:)**
Email address accessible on the test mobile.
- Specify the duration of the email campaign by completing:
 - # of emails to send
 - Interval between emails
- If desired, Generate Test Email to be sent to the mobile device.

☐ Initiate email campaign when logging starts

Recipient email address (To):

of emails to send:

Interval between emails: seconds

Estimated duration: 00:00:00 (hh:mm:ss)

Figure 9-12 - Email Campaign Dialog

- Start a new test.
- During testing and when analyzing results in the output report, watch for performance differences between the multi-RAB and the control device. Remember that the goal of this test is to compare the voice quality or call performance of a mobile engaged in data services to a device not transferring data.

9.10 Voice Delay Testing

Nomad allows the precise measurement of speech delay between two mobile devices connected to the same Spirent ME unit. The measurement includes delay introduced by both handsets and the time it takes to traverse the network.

High levels of delay (generally over 250 milliseconds round-trip) may impact typical conversation. In the presence of high delay levels, normal conversation breaks down, as speakers are likely to interrupt each other and speak over each other during the call. Additionally, delay can exacerbate annoying echo problems.

Note: The Delay Task cannot be run with any other tasks. All other tasks must be removed from the **Test Setup** screen before configuring a **Delay Task**.

To perform Voice Delay testing:

- Connect one handset to **Channel 1** (ME) or **NB1** (HD ME) via audio cable. Connect the second handset to **Channel 2** (ME) or **NB2** (HD ME).

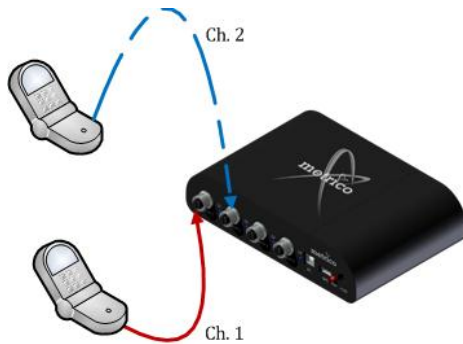


Figure 9-13 - Voice Delay Hardware Configuration

- On the Nomad **TestSetup** screen, configure **Channel 1** as a **Voice Delay** task with the following settings:
 - **Destination Channel:** 2
 - **Cycles:** The desired number of cycles to define the length of the test. The total sample count for a test will be **Cycles** multiplied by **Samples Per Cycle**.

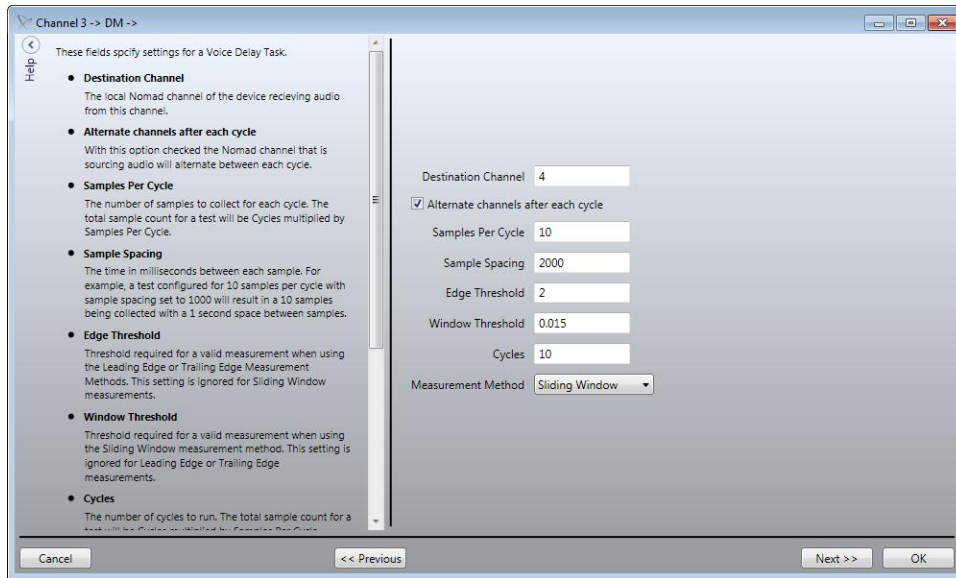


Figure 9-14 - Voice Delay Task Session Dialog

- Spirent recommends leaving the default values for the remaining items in the **Session** dialog. Maintaining the default parameters ensures consistency across tests for benchmarking purposes. Definitions of each parameter are provided here for informational purposes:
 - **Alternate channels after each cycle:** With this option checked, the Nomad channel that is sourcing audio will alternate between each cycle.
 - **Samples Per Cycle:** The number of measurements to take for each Voice Delay Task cycle.
 - **Sample Spacing:** The time in milliseconds between each sample. For example, a test configured for 10 samples per cycle with sample spacing set to 1000 will result in 10 samples collected with 1 second between each sample.
 - **Edge Threshold:** The threshold required for a valid measurement when using the **Leading Edge** or **Trailing Edge** measurement methods. This setting is ignored for **Sliding Edge** measurements.
 - **Window Threshold:** The threshold required for a valid measurement when using the **Sliding Window** measurement method. This setting is ignored for **Leading Edge** or **Trailing Edge** measurements.
 - **Measurement Method:** The method that will be used for audio detection. Possible settings are:
 - **Sliding Window:** This is the preferred and most accurate delay measurement method. Measurements are taken using a sliding window correlation algorithm. The default value is 0.015. Higher values will reject weaker signals more readily.
 - **Leading Edge:** Delay measurements are taken from the leading edge of received audio data.
 - **Trailing Edge:** Delay measurements are taken from the trailing edge of received audio data.
- Place a call from **Handset 1** to **Handset 2**. The incoming call must be manually answered.
- Start a new test.

- The test sequence starts with **Handset 1** sourcing audio to **Handset 2**. Assuming **Alternate channels after each cycle** has been selected, in the next cycle **Handset 2** will source audio to **Handset 1**.
- The **Average Delay** and **Median Delay** will be plotted for each direction on the **Delay Times (ms) / Cycle** chart.
- Detailed statistics for each test cycle are available in the **Cycle History** area.

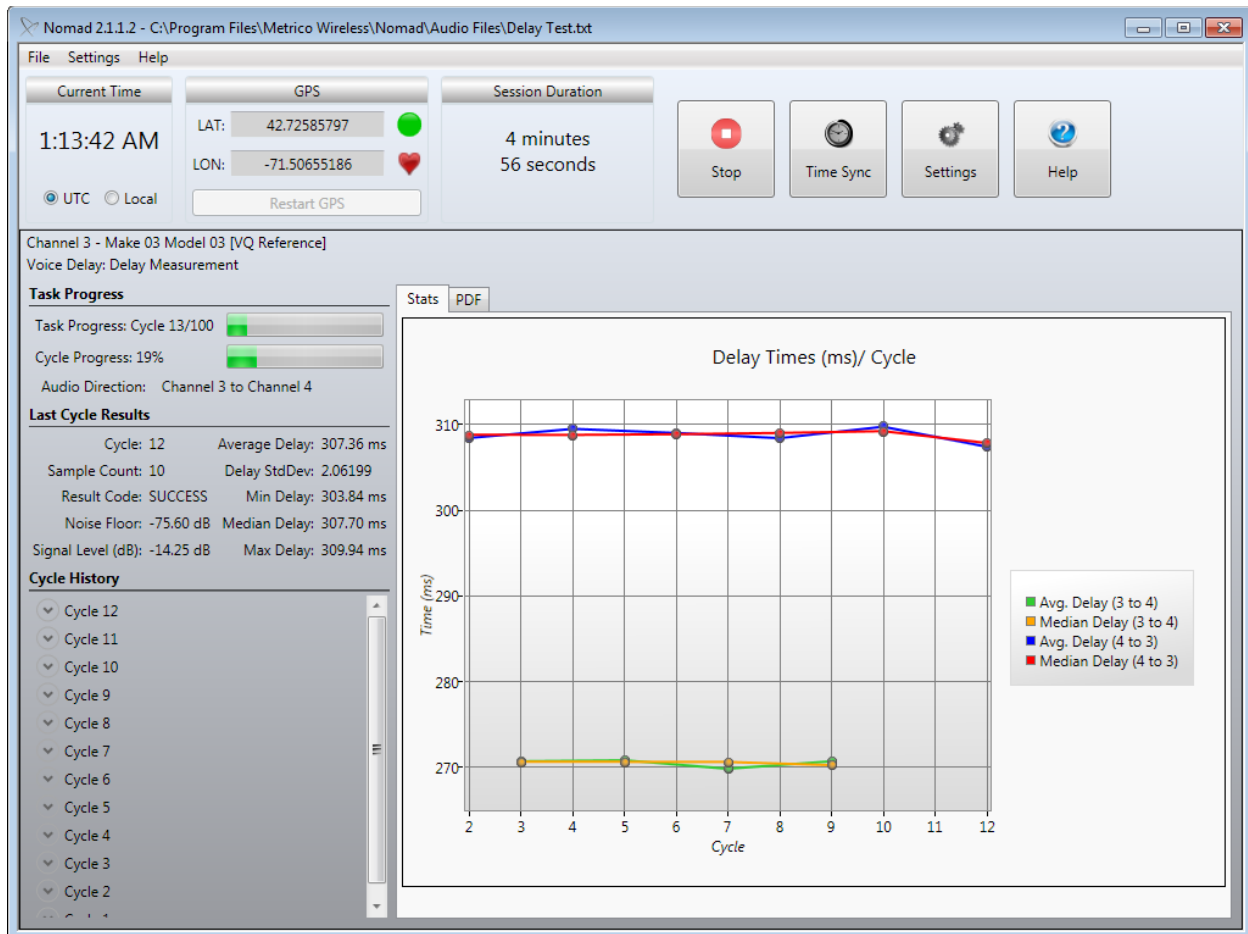


Figure 9-15 - Voice Delay Testing

While monitoring the data during testing, be mindful of the following:

- Confirm that each individual cycle has completed and that Nomad has reported data.
- Confirm that the **Delay Times** chart updates for each cycle.

The test will stop after the configured number of **Cycles** has been completed. Alternatively, use the **Stop** button to end the test at any time as desired.

Delay test results can be found on the **Delay Performance Summary** tab of the output report.

Note: Delay measurements greater than 250 milliseconds round-trip are considered “high” and are generally detectable during standard conversation.

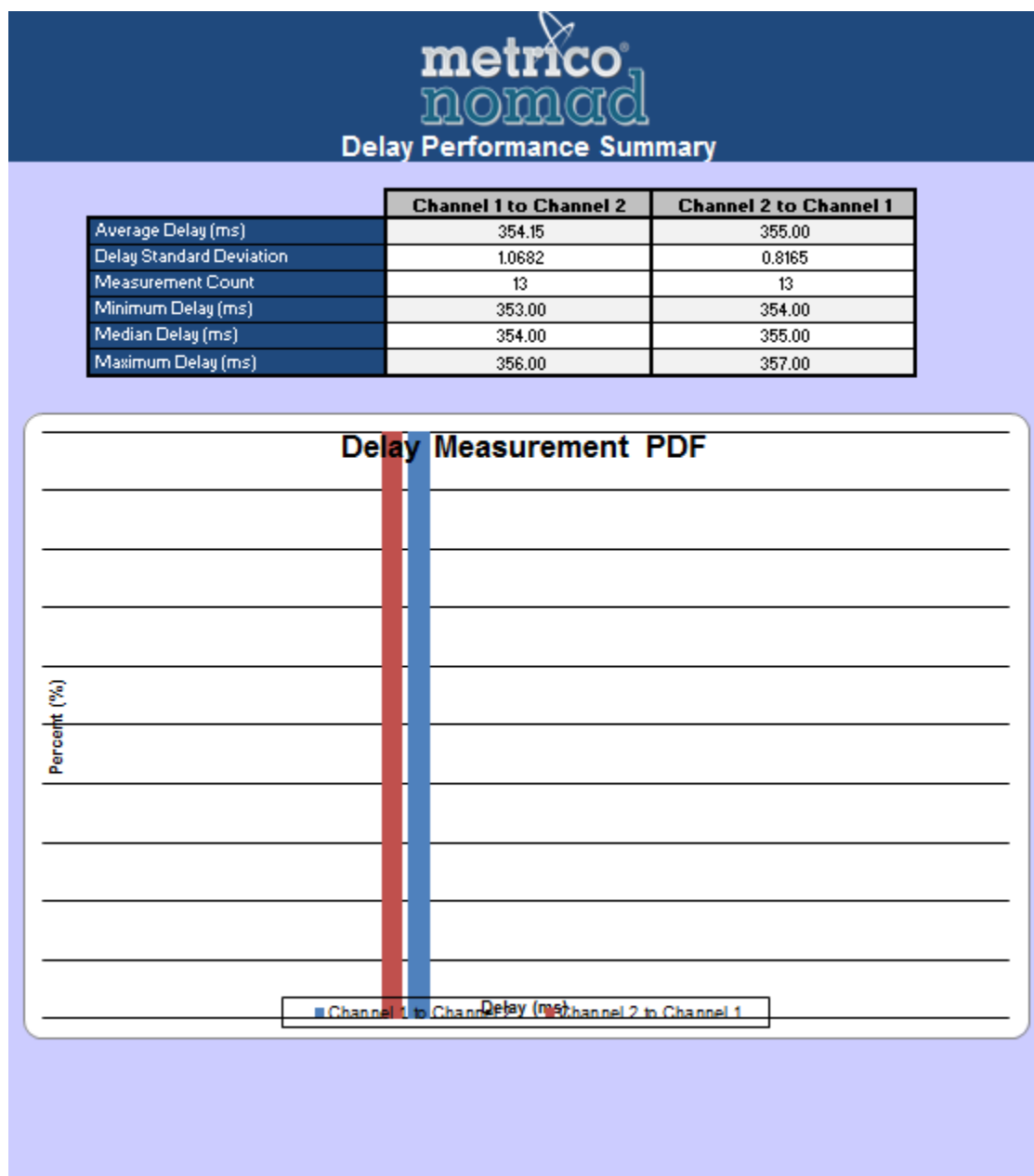


Figure 9-16 - Delay Performance Summary Report

10 Call Performance Configuration Options

Nomad provides various configuration options for call performance testing. These options include:

- [Mobile Originated Testing](#)
- [Mobile Terminated Testing](#)
- [Mobile-to-Mobile Testing](#)

This section contains detailed instructions for each call performance configuration option.

10.1 Mobile Originated Testing

In a Mobile Originated test, the mobile test device makes calls to the Call Server for call control testing. To perform Mobile Originated call performance testing:

- Set the volume of the test handset to the maximum volume for optimal Audio Verification results.
- Determine which channel the test will be conducted on. All call performance testing operates via Bluetooth connection.
- On the Nomad **TestSetup** screen, configure that channel as a **Mobile Originated** task with the following settings in the **Call Campaign** dialog:
 - **Dial/Answer Method:** This field will only be visible to customers who have purchased the ability to control devices via a tethered connection. This drop-down allows those customers to choose between controlling via the Bluetooth connection, or the tethered connection.
 - **Phone Number Settings:** Enter the **Number to call** as provided by Spirent and the **Number calling from**.
 - **Call Initiation Mode:**
 - **Synchronous Testing** – Calls start simultaneously on all devices regardless of call outcomes. For example, if one device drops a call, it will remain idle until the next time all mobiles are scheduled to start a new call.
 - **Asynchronous Testing** – Each device follows its own call sequence without regard to other device progress. In this mode, if one device drops a call, it will wait for the specified time and then start a new call, even as the other devices continue their first call.
 - **Access Timeout** – A call attempt that has not connected within this amount of time will be classified as an Access Timeout event.
 - **Duration** – The length of each call in the test sequence.
 - In a **Synchronous** campaign, this refers to the total attempt duration including access time and connected time.
 - In an **Asynchronous** campaign, this refers to the connected time only.
 - **Wait Time** – The amount of idle time between the end of one call in the sequence and the start of the next call.
 - **Attempts** – The number of calls to attempt in this task sequence.

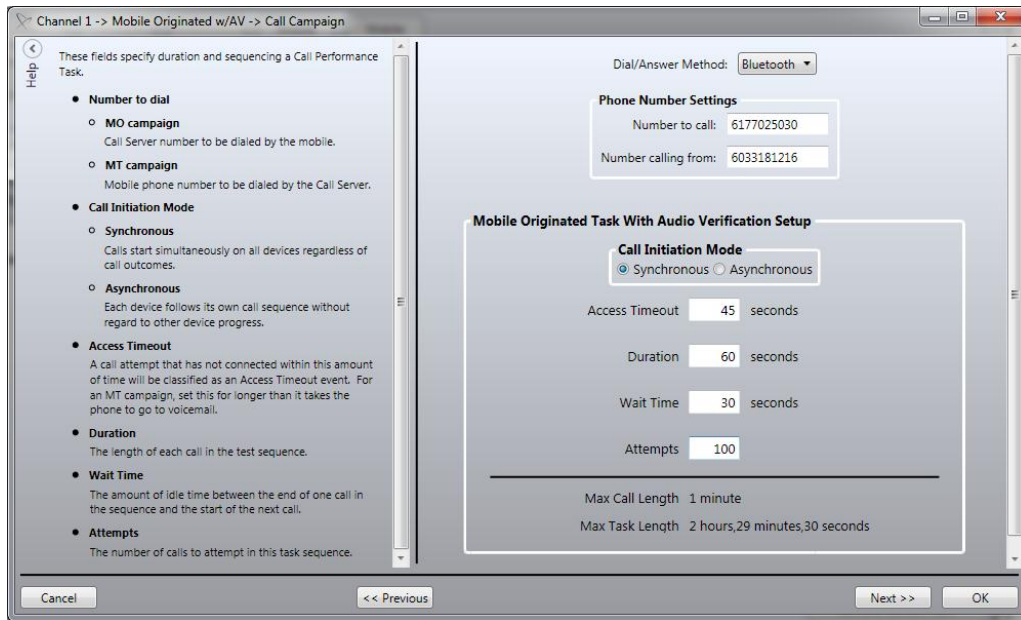


Figure 10-1 - Call Campaign Dialog for a Mobile Originated Task

- Establish the Bluetooth connection for the test device.
- Click the **Start Logging Session** button and proceed through the **Start Logging Session Wizard**.
- Calls will automatically be placed from the test handset to the Call Server.
- During testing, the call status is displayed in the **Call Performance Task Status Window**. Session statistics are displayed in the **Call Performance Statistics Window**. See [Section 7.1](#) for details about the display.

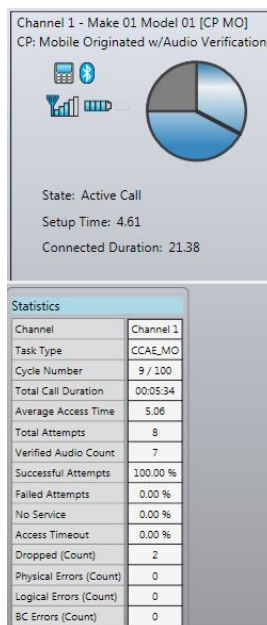


Figure 10-2 - Mobile Originated Call Performance Testing

- The test will stop after the configured number of **Attempts**. Alternatively, use the **Stop** button to end the test at any time as desired.

Test results can be found on the **Call Performance Summary**, **Call Initiation**, **Call Retention**, **Audio Verification** and **Device Performance** tabs of the output report.

10.2 Mobile Terminated Testing

In a Mobile Terminated test, the Call Server makes calls to the mobile test device for call control testing. To perform Mobile Terminated call performance testing:

- Set the volume of the test handset to the maximum volume for optimal Audio Verification results.
- Determine which channel the test will be conducted on. All call performance testing operates via Bluetooth connection.
- On the Nomad **TestSetup** screen, configure that channel as a **Mobile Terminated** task with the following settings:
 - **Dial/Answer Method:** This field will only be visible to customers who have purchased the ability to control devices via a tethered connection. This drop-down allows those customers to choose between controlling via the Bluetooth connection, or the tethered connection.
 - **Number to dial:** The mobile phone number to be dialed by the Call Server.
 - **Call Initiation Mode:**
 - **Synchronous Testing** – Calls start simultaneously on all devices regardless of call outcomes. For example, if one device drops a call, it will remain idle until the next time all mobiles are scheduled to start a new call.
 - **Note: Synchronous Testing** may not be maintained for Mobile Terminated call campaigns.
 - **Asynchronous Testing** – Each device follows its own call sequence without regard to other device progress. In this mode, if one device drops a call, it will wait for the specified time and then start a new call, even as the other devices continue their first call.
 - **Turn off answering** – Turns off automatic answering of incoming calls, to facilitate manual intervention.
 - **Access Timeout** – A call attempt that has not connected within this amount of time will be classified as an Access Timeout event.
 - **Duration** – The length of each call in the test sequence.
 - In a **Synchronous** campaign, this refers to the total attempt duration including access time and connected time.
 - In an **Asynchronous** campaign, this refers to the connected time only.
 - **Wait Time** – The amount of idle time between the end of one call in the sequence and the start of the next call.
 - **Attempts** – The number of calls to attempt in this task sequence.

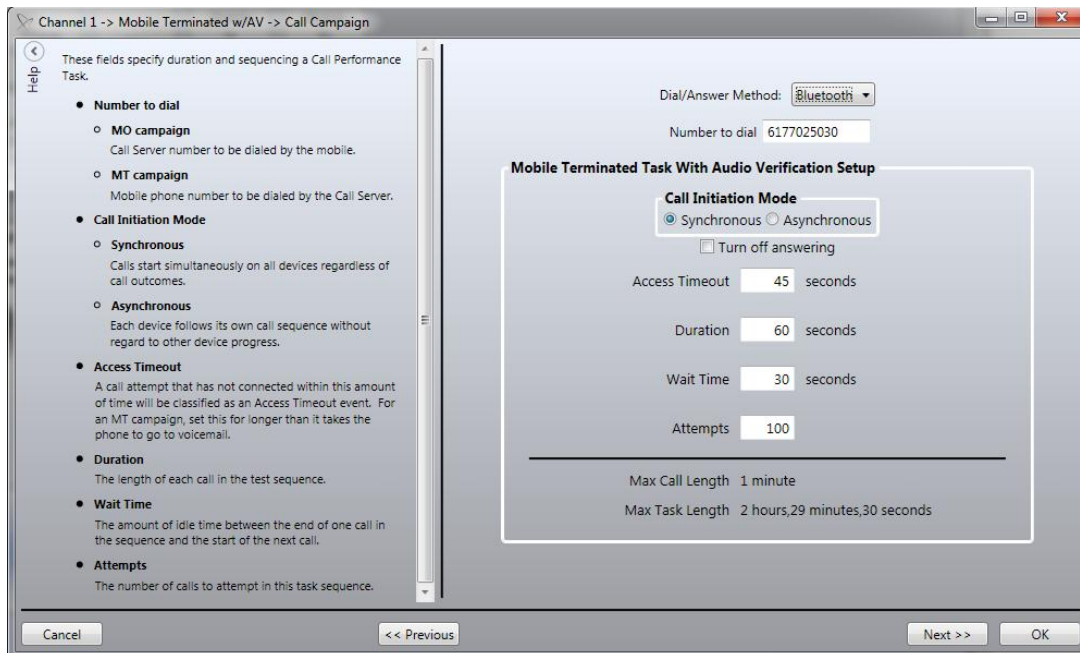


Figure 10-3 - Call Campaign Dialog for a Mobile Terminated Task

- Establish the Bluetooth connection for the test device.
- Click the **Start Logging Session** button and proceed through the **Start Logging Session Wizard**.
- Calls will automatically be placed from the **Call Server** to the test handset.
- During testing, the call status is displayed in the **Call Performance Task Status Window**. Session statistics are displayed in the **Call Performance Statistics Window**. See [Section 7.1](#) for details about the display.
- **Note:** Only those fields for which data is available at the mobile end will be populated in the Call Performance Statistics window during Mobile Terminated testing. The remaining fields will display as PENDING during the test. The statistics for these fields will be compiled in the formatted output report generated at the conclusion of testing. The affected fields are:
 - Average Access Time
 - Failed Attempts
 - No Service
 - Access Timeout
 - Dropped (Count)

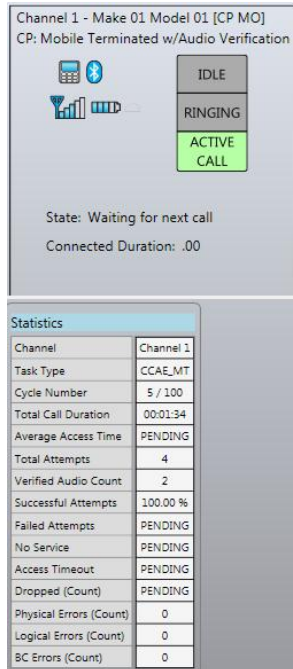


Figure 10-4 - Mobile Terminated Call Performance Testing

- The test will stop after the configured number of **Attempts**. Alternatively, use the **Stop** button to end the test at any time as desired.
- **Note:** Losing internet connectivity during a Mobile Terminated Call Performance campaign may cause the **Stop** button to cease working. In this case, wait for a call to come to the phone, answer the call and dial 9999. This will manually stop the Call Server from repeatedly calling the phone through the scheduled end of the test.

Test results can be found on the **Call Performance Summary**, **Call Initiation**, **Call Retention**, **Audio Verification** and **Device Performance** tabs of the output report.

Spirent recommends following these best practices for the best results with Mobile Terminated testing:

- Confirm that the test handset is properly configured with voicemail. This will ensure that voicemail is properly detected during testing.
- The **Access Timeout** parameter for a Mobile Terminated call campaign must be set to a larger duration than it takes the phone to go to voicemail. If **Access Timeout** is too short, Nomad will fail to recognize a call sent to voicemail. Instead, such a call will be classified as an **Access Timeout** before voicemail picks up. A 45-second **Access Timeout** is generally sufficient for North American carriers.
- Nomad can take up to seven seconds to detect voicemail. In a **Synchronous** campaign it is best practice to set **Duration** at least seven seconds longer than **Access Timeout** to ensure that no Voicemail events are missed.

10.3 Mobile-to-Mobile Testing

In a Mobile-to-Mobile test, one handset makes calls that are received by a second handset attached to a different channel on the same Spirent ME unit. To perform Mobile-to-Mobile call performance testing:

- Determine which handset will be the originating device and which handset will be the receiving device. All call performance testing operates via Bluetooth connection.
- On the Nomad **TestSetup** screen, configure **Channel 1** as a **Mobile-to-Mobile Originate** task with the following **Call Campaign** settings:
 - **Receiving Device:** Receiver on **Channel 2**.
 - **Number to dial:** The phone number of the receiving test device.
 - **Access Timeout:** A call attempt that has not connected within this amount of time will be classified as an **Access Timeout** event.
 - **Duration:** The length of each call in the test sequence.
 - **Wait Time:** The amount of idle time between the end of one call and the start of the next call.
 - **Attempts:** The number of calls to attempt in this call sequence.
- **Note:** All Mobile-to-Mobile call performance tasks are **Synchronous**. Therefore, there is no option to select the **Call Initiation Mode**.

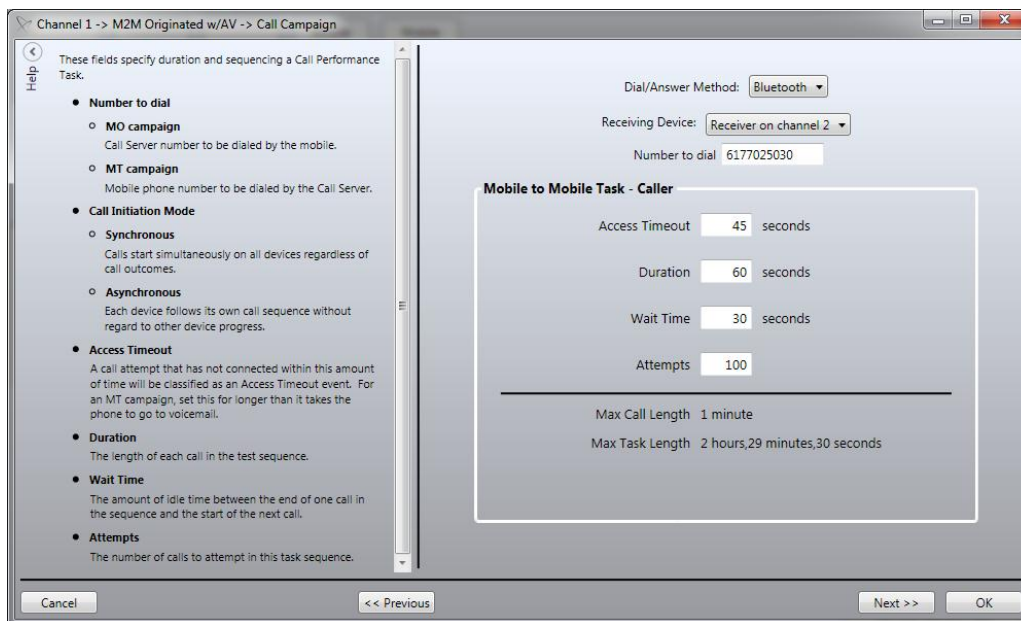


Figure 10-5 - Mobile-to-Mobile Originated Call Campaign Dialog

- **Channel 2** will automatically be configured as a **Mobile-to-Mobile Receive** task. Confirm that the **Incoming number** in the **Call Campaign** dialog matches the phone number of the **Mobile-to-Mobile Originating** device. The settings here are pulled automatically from the **Mobile-to-Mobile Originate** task and are not editable here. These settings will change automatically when changes are made to the **Mobile-to-Mobile Originate** task.

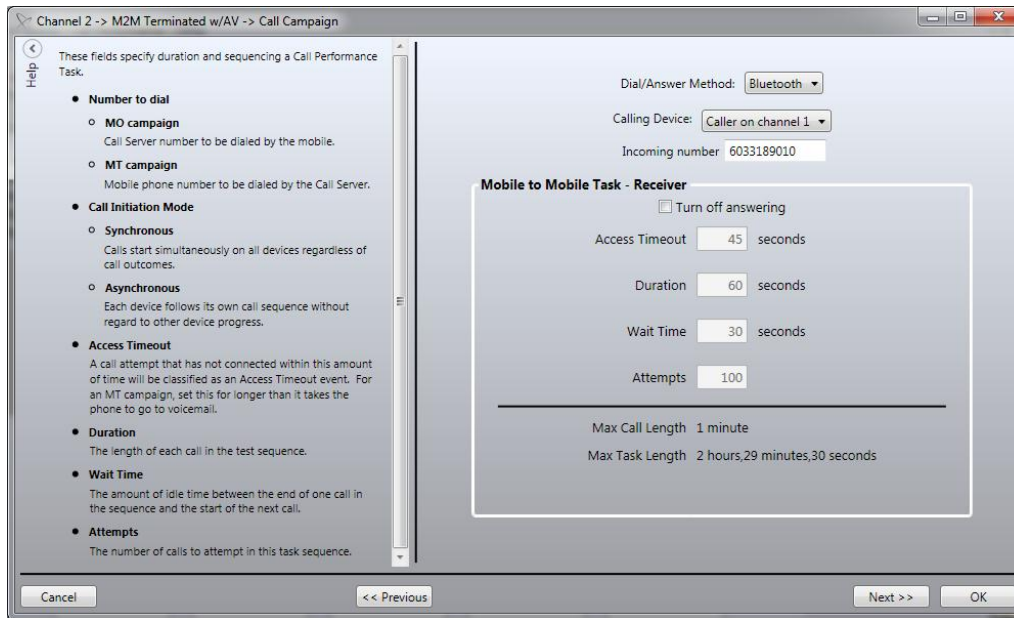


Figure 10-6 - Mobile-to-Mobile Terminated Call Campaign Dialog

- Establish the Bluetooth connection for both test devices.
- Click the **Start Logging Session** button and proceed through the **Start Logging Session Wizard**.
- Calls will automatically be placed from the originating handset to the receiving handset.
- During testing, the call status is displayed in the **Call Performance Task Status Window** for each device. Session statistics for both devices are displayed in the **Call Performance Statistics Window**. See [Section 7.1](#) for details about the display.

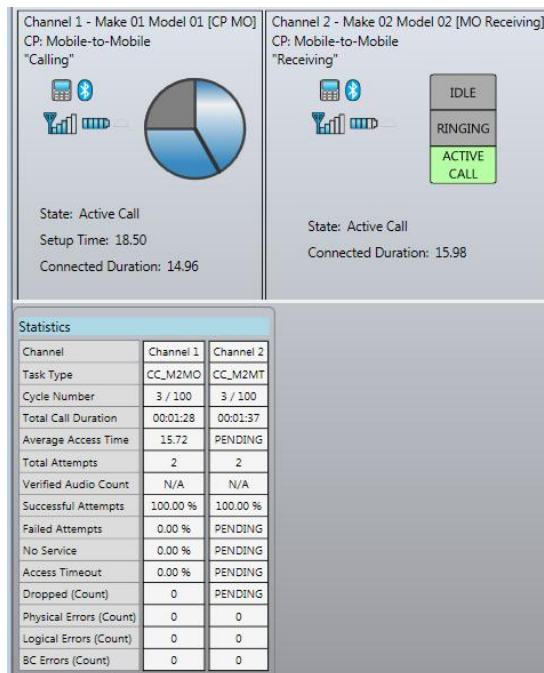


Figure 10-7 - Mobile-to-Mobile Call Performance Testing

When testing is complete, the matching Mobile Originated and Mobile Terminated results are merged together to create a single session file. Generate a report in the standard manner for this merged session file. Test results can be found on the **Call Performance Summary**, **Call Initiation**, **Call Retention**, **Audio Verification** and **Device Performance** tabs of the output report.

In the report, the Mobile to Mobile “Calling” channel is treated as a Mobile Originated task. The Mobile to Mobile “Receiving” channel is treated as a Mobile Terminated task. The statistics reported for the two tasks will likely be similar, with a few key differences:

- **Call Initiation Statistics** – Calls that failed on the MO side will not be represented on the MT side. Specifically, initiations classified as **Failed Attempts**, **No Service** or **Access Timeout** will be counted on the MO channel but not on the MT channel.
- **Setup Time** – The Setup Time is generally larger for MT calls than for MO calls.

Spirent recommends following this best practice for the best results with Mobile-to-Mobile call performance testing:

- The **Access Timeout** parameter for a Mobile-to-Mobile call campaign must be set to a larger duration than it takes the phone to go to voicemail. If **Access Timeout** is too short, Nomad will fail to recognize a call sent to voicemail. Instead, such a call will be classified as an **Access Timeout** before voicemail picks up. A 45-second **Access Timeout** is generally sufficient for North American carriers.

Appendix A – Glossary

General Testing Terms

Term	Definition
Call Performance Task	A task designed to measure how well the device performs with regard to call initiation, call retention, Bluetooth performance, signal strength and battery life.
Configured Task	A Configured Task saves all of the settings for the currently selected task.
Session Profile	A Session Profile defines the tasks and settings for all available test channels.
Task	The type of activity to be performed on an available test channel.
Test	The arrangement of the available Nomad channels based on the task types and settings available for each.
Voice Quality Task	A task designed to measure how speech is perceived by the end user of the test device.

Voice Quality Testing Terms

Term	Definition
Base Task	<p>The test device on a Base channel serves as the uplink device in the mobile communication path. This option should be selected for:</p> <ul style="list-style-type: none">• The uplink end of a Landline Module test.• One of the test handsets in a bi-directional Mobile-to-Mobile test scenario (the other handset will be set as a Mobile).• One of the test handsets in a bi-directional Remote Unit test scenario (the other handset will be set as a Mobile).

Term	Definition
Mobile Task	<p>The test device on a Mobile channel serves as the downlink device in the mobile communication path. This option is used for:</p> <ul style="list-style-type: none"> • Standard bi-directional testing using the Audio Server. • A mobile acting as the downlink device in a test using the Landline Module. • One of the test handsets in a bi-directional Mobile-to-Mobile test scenario (the other handset will be set as a Base). • One of the test handsets in a bi-directional Remote Unit test scenario (the other handset will be set as a Base).
Record Only Task	Select this option to perform downlink testing only. With this setting, Nomad will record speech every ten seconds but will not source speech. This setting can be used to shorten the test cycle time in the event that only downlink data is required.
Source Only Task	Select this option to perform uplink testing only. With this setting, Nomad will send speech every ten seconds but will not record anything. This setting can be used to shorten the test cycle time in the event that only uplink data is required.

Call Performance Testing Terms

Term	Definition
Asynchronous Testing	Each device follows its own call sequence without regard to other device progress. In this mode, if one device drops a call, it will wait for the specified time and then start a new call, even as other devices continue their first call.
Idle Task	The test device makes no calls. This type of task only reports changes in signal strength and battery level.
Mobile Originated Task	Calls are made from the mobile test device to the Call Server.
Mobile Terminated Task	Calls are made from the Call Server to the mobile test device.
Synchronous Testing	Calls start simultaneously on all devices regardless of individual call outcomes. For example, if one device drops a call, it will remain idle until the next time all mobiles are scheduled to start a new call.

Appendix B – Call Performance Events

Call Outcome Events

Call Outcome	Definition
No Service	<ul style="list-style-type: none"> There was no service available when the call was attempted.
Failed Attempt	<ul style="list-style-type: none"> A <i>Mobile Originated Call</i> was placed and an outgoing call was established followed by the phone's return to the call placement state.
Voicemail	<ul style="list-style-type: none"> A <i>Mobile Terminated</i> call was placed and the nonstandard <i>voicemail</i> response was received from the mobile.
Busy	<ul style="list-style-type: none"> A <i>Mobile Terminated</i> call was placed and the nonstandard <i>busy</i> response was received from the mobile. A <i>busy</i> response typically results when the network is unable to place the call.
Fast Busy	<ul style="list-style-type: none"> A <i>Mobile Terminated</i> call was placed and the nonstandard <i>fast busy</i> response was received from the mobile. Both the <i>fast busy</i> response and the <i>no capacity</i> response typically indicate an issue with the communication path to the server.
No Capacity	<ul style="list-style-type: none"> A <i>Mobile Terminated</i> call was placed and the nonstandard <i>no capacity</i> response was received from the mobile. Both the <i>fast busy</i> response and the <i>no capacity</i> response typically indicate an issue with the communication path to the server.
Access Timeout	<ul style="list-style-type: none"> <i>Mobile Originated Call</i> – A call was placed but no state change occurred before the Access Timeout time. <i>Mobile Terminated Call</i> – The connection did not take place before the Access Time.
Drop	<ul style="list-style-type: none"> The call was ended before the expected duration had elapsed.
Physical Link Error	<ul style="list-style-type: none"> The Bluetooth connection between the test mobile and the Nomad hardware unit was not active at the time a call was supposed to occur.
Logical Device Error	<ul style="list-style-type: none"> The test mobile failed to respond properly to a command issued by Nomad via the Bluetooth connection.
BC Error (BlueCore Error)	<ul style="list-style-type: none"> The Bluetooth module was not in a nominal state at the time a call was supposed to occur.
User Terminated	<ul style="list-style-type: none"> The Stop button on the handset was pressed during a call.
Call Succeeded	<ul style="list-style-type: none"> Any call that lasts the expected duration is considered a successful call.

Device State Events

Device State Event	Definition
Device State Value	<ul style="list-style-type: none">• The device may change to any of the following:<ul style="list-style-type: none">○ Initializing○ Ready○ Discovering○ Connecting○ Connected○ Outgoing Call Established○ Incoming Call Established○ Active Call
Signal Strength	<ul style="list-style-type: none">• The phone signal strength corresponding to the handset bar display (0 – 5)
Battery Life	<ul style="list-style-type: none">• The phone battery life corresponding to the handset bar display (0 – 5)
RSSI	<ul style="list-style-type: none">• The RSSI reported by the handset (-113 to -51 dBm); this feature is device-dependent and only available on phones that support RSSI reporting

Appendix C – Confidence Interval Calculation

The Nomad Call Performance output reports employ a 90% Confidence Interval for call initiation failure and dropped call events. The Confidence Interval allows us to report, with 90% confidence, that the event rate for a given device will fall within the calculated range above and below the measured value. The Confidence Interval is calculated as a function of the estimated standard deviation of the sample proportion (% dropped calls or % call initiation failures) and the standard normal distribution function.

$$\text{Confidence Interval} = \bar{p} \pm z(a) * s(\bar{p})$$

$$\bar{p} = \text{sample proportion} = \% \text{ dropped calls or \% call initiation failures}$$

$$n = \text{total connection attempts}$$

$$z(a) = z(90\text{th percentile}) = 1.645 \text{ (based on standard normal distribution)}$$

$$s(\bar{p}) = \sqrt{\frac{\bar{p}(1 - \bar{p})}{n - 1}} = \text{estimated standard deviation of } \bar{p}$$

therefore

$$\text{Confidence Interval} = \bar{p} \pm 1.645 * \sqrt{\frac{\bar{p}(1 - \bar{p})}{n - 1}}$$

Appendix D – PESQ Tools GUI Case Study

The **PESQ Tools GUI** is available for Nomad users wishing to perform advanced analysis of any waveform captured during **Voice Quality** testing and scored using PESQ. Basic operation of the **PESQ Tools GUI** is described in [Section 8.7](#).

The **PESQ Tools GUI** can assist in the identification of issues that contribute to low MOS such as background noise and speech clipping. This appendix presents a case study illustrating how the **PESQ Tools GUI** may be used to identify these types of issues in a test file exhibiting low MOS results.

To start, the **Reference Waveform**, **Reference Surface** and **Reference Spectrogram** tabs display what the test waveform should look like. The **Degraded Waveform**, **Degraded Surface** and **Degraded Spectrogram** tabs display what the waveform actually looks like. Sample waveforms with low MOS results will contain visible differences from the reference images.

In this example, the **Reference Waveform** is free of noise during periods without speech while the **Degraded Waveform** exhibits a constant buzzing during “quiet” periods:

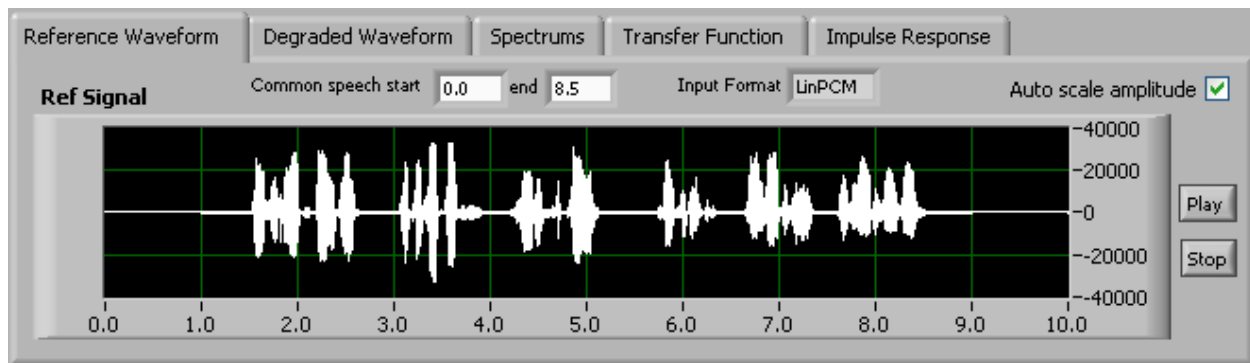


Figure D-1 - Reference Waveform

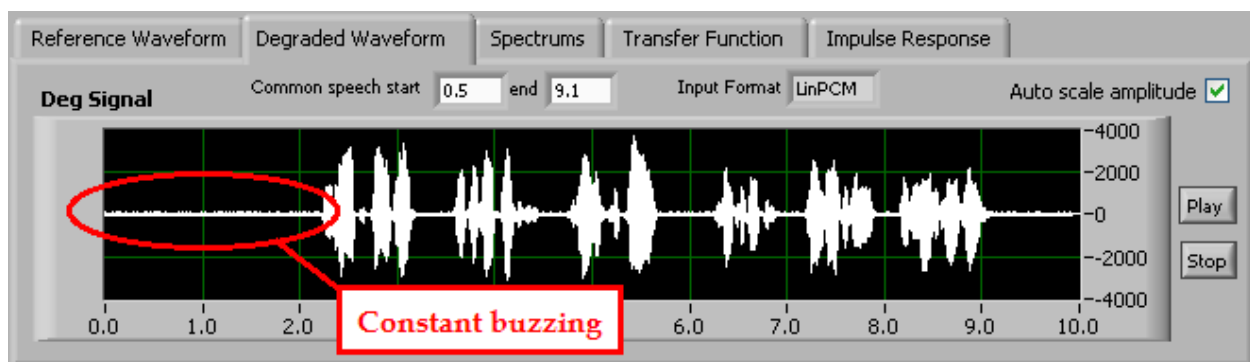



Figure D-2 - Degraded Waveform

Not only is this buzzing visible in the **Degraded Waveform** image, it is audible in the .WAV file. Use the **Play**  button to listen to the effect of the buzzing on the speech sample.

The issue of speech clipping is visible when comparing the **Reference Surface** to the **Degraded Surface**:

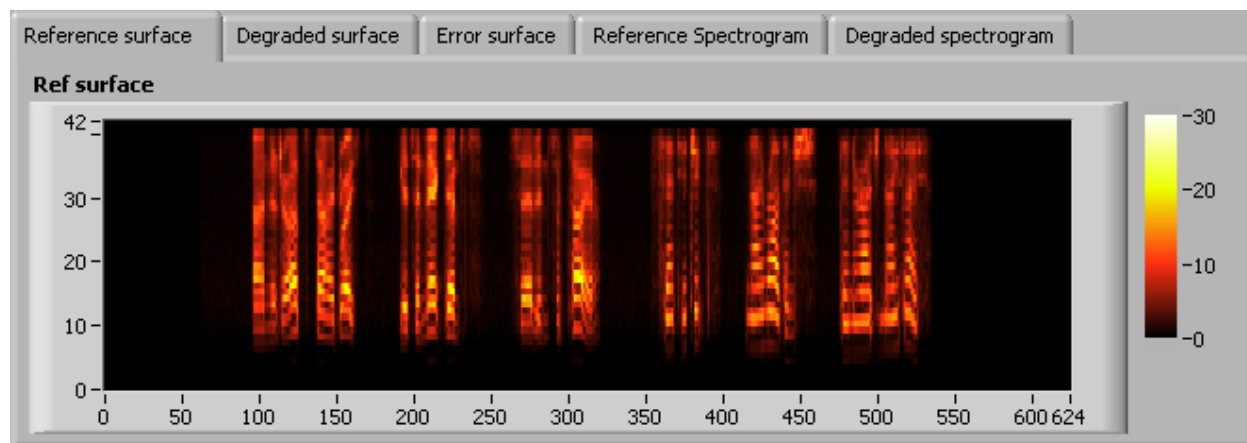


Figure D-3 - Reference Surface

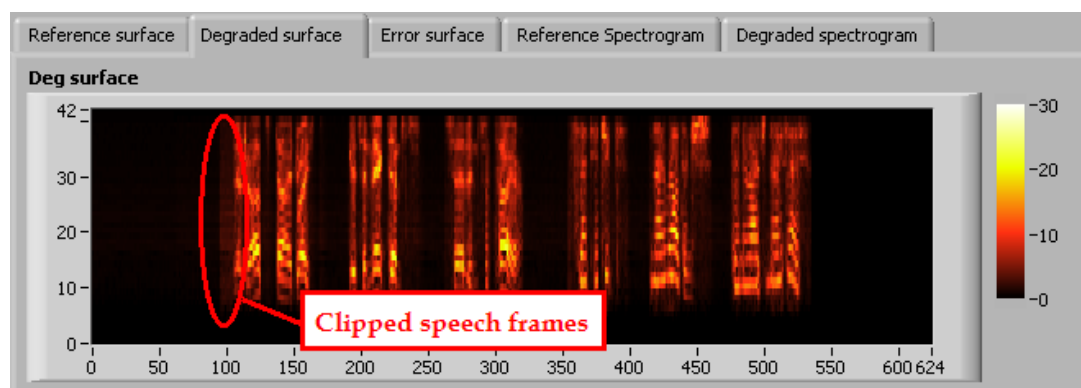


Figure D-4 - Degraded Surface

Speech clipping is also apparent on the **Error Surface** graph. The **Error Surface** represents the **Reference Surface** minus the **Degraded Surface**. Therefore, errors that represent missing signal (i.e. clipping) will have positive values on this chart. Errors that add to the signal (i.e. noise) will have negative values here.

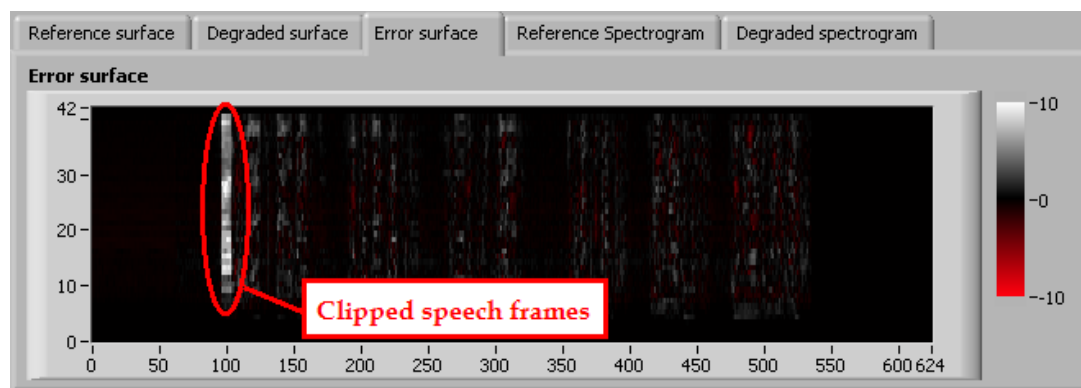


Figure D-5 - Error Surface

The Reference and Degraded Signal spectrums available in the **PESQ Tools GUI** provide another means of analysis. These figures can be used to visually compare the reference to the degraded frequency response. Note that although this example exhibits frequency fade above 3.5 kHz, this is a normal response for mobiles calling the Audio Server and is not expected to affect the MOS outcome.

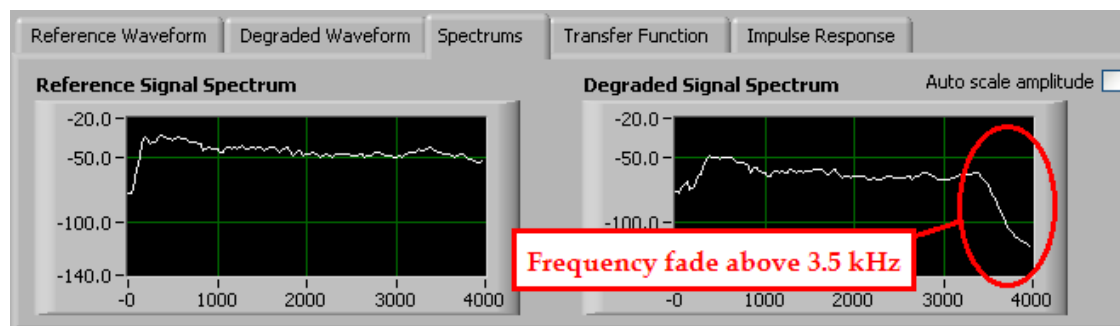


Figure D-6 - Reference and Degraded Signal Spectrums

The buzzing, clipping and frequency response characteristics are all apparent upon comparison of the **Reference Spectrogram** to the **Degraded Spectrogram**. The Spectrogram graphs provide frequency spectra information over the duration of the sample.

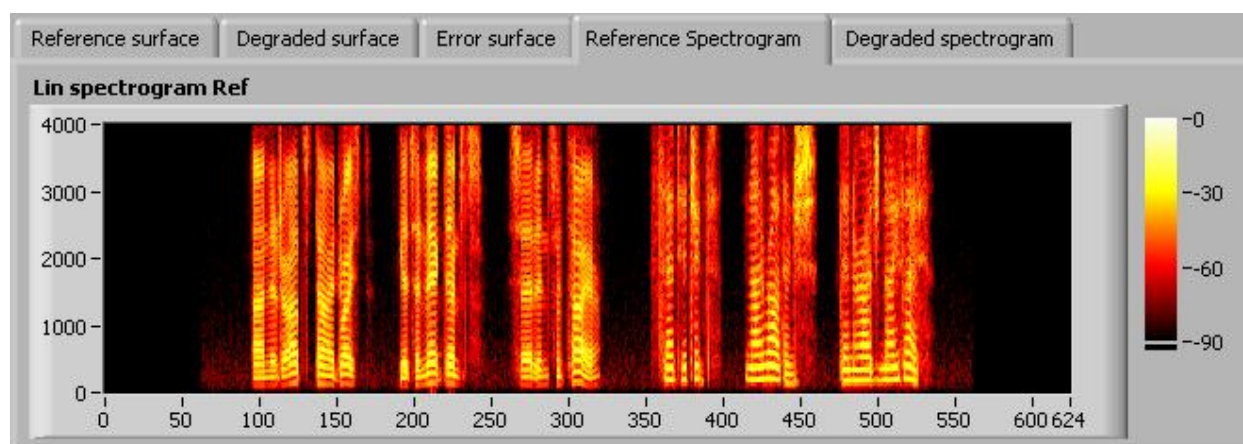


Figure D-7 - Reference Spectrogram

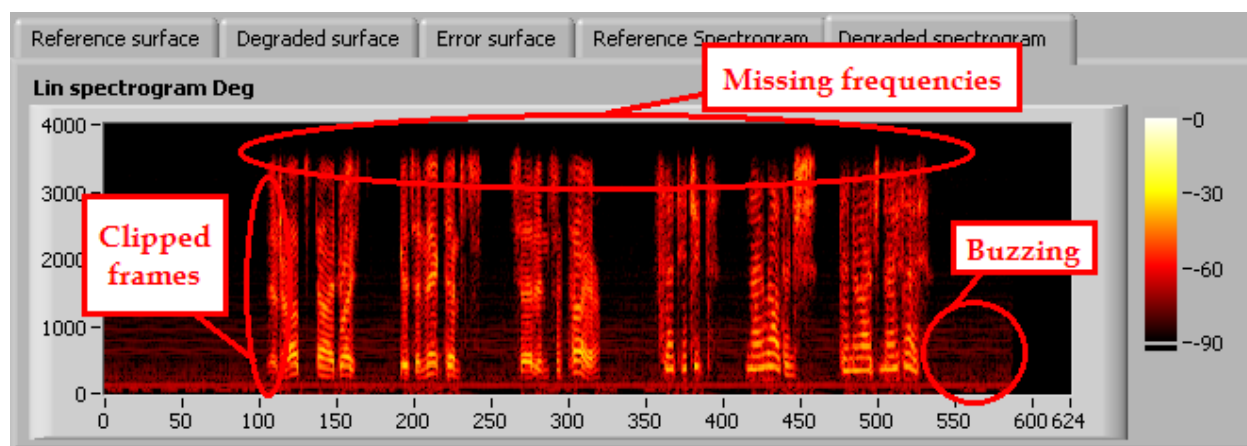


Figure D-8 - Degraded Spectrogram

In conclusion, this example has illustrated how the **PESQ Tools GUI** may be used to identify specific areas of a speech sample contributing to poor MOS results. In this case, multiple factors of background buzzing and speech clipping were identified. Using this information, the source of each issue may now be identified and rectified in order to achieve the desired MOS results.

Appendix E – Introduction to POLQA

The worldwide prevailing standard for mobile voice quality analysis has been ITU-T P.862, known as Perceptual Evaluation of Speech Quality (PESQ). PESQ implements automated testing of telecommunications using actual speech samples, comparison of the reference signal (transmitting side) to the degraded channel (listening side), and generation of mean opinion scores (MOS) to model subjective listening patterns. This technique has been widely adopted due to its capability to automate collections of large sample sets simulating real-world subscriber experience.

As network technologies mature and evolve, the drivers of performance change, and new methodologies for measuring and assuring quality are required. PESQ is logically being succeeded by ITU-T P.863, Perceptual Objective Listening Quality Analysis (POLQA).

Advantages of POLQA include:

- Significantly expanded set of codecs, including AMR-WB, EVRC, EVRC-WB, Skype / SLIK, G.711 and G.729.
- Designed to handle more complex end-to-end network architectures and quality management techniques such as smart loss concealment and time stretching.
- Two operational modes to distinctly address narrowband and super-wideband communication.
- Three-fold increase in evaluation set used compared to PESQ, resulting in considerably smaller residual prediction errors even as the application range has expanded substantially.
- Seamless upgrade path from, and backward compatibility with, PESQ.

POLQA provides more robust quality predictions for:

- Cross-technology quality benchmarking (such as GSM vs. CDMA)
- Noise reduction and voice quality enhancement
- Time scaling, unified communication and VoIP
- Non-optimal presentation levels
- Filtering and spectral shaping
- Recordings made at an ear simulator

The table below compares PESQ and POLQA at a glance:

	PESQ	POLQA
Codecs	<ul style="list-style-type: none"> • AMR • EFR 	<ul style="list-style-type: none"> • AMR • AMR-WB • EFR • EVRC • EVRC-WB • iLBC • AMB+ • AAC • Skype / SILK • G.711 • G.729
Reference Speech Material	<ul style="list-style-type: none"> • 8 kHz 	<ul style="list-style-type: none"> • 8 kHz • 48 kHz
Applications	<ul style="list-style-type: none"> • POTS • VoIP • 3G 	<ul style="list-style-type: none"> • HD Voice • Voice Enhancement Devices • Skype Calls • Benchmarking CDMA and GSM

POLQA scoring is available as an optional upgrade to Nomad. To configure a POLQA-enabled Nomad installation for POLQA scoring:

- On the **Settings**→**Voice Quality** tab, set the **Default Scoring Algorithm** to **POLQA**.
- When creating a new Voice Quality task, confirm that the **Scoring Model** in the **Session** dialog is set to **POLQA**.

During a Voice Quality test using POLQA, the **Voice Quality Task Status Window** displays **Attenuation** as the amplitude of the current waveform. **Attenuation** measures the downlink signal gain reduced by Nomad. For the best results, Spirent Communications recommends maintaining downlink attenuation between 0 and 7 dB, ideally as close to 0 dB as possible. Increase **Input Level** to decrease **Attenuation** toward 0 dB. Note that compared to PESQ, POLQA is more forgiving when it comes to attenuation adjustment.

During a Voice Quality test using POLQA, the **Voice Quality Task Status Window** displays the **Algorithm** as **POLQA**.



Figure E-0-1 - Voice Quality Task Status Window for a POLQA Test

When generating the output report, Nomad always scores the data using the **Scoring Model** specified in the test definition. For example, a test defined with the **POLQA** scoring model will be scored using **POLQA**. Three options exist to score the same data using the other scoring model:

- **Re-score Files** – On the **Data → Complete** tab, right-click on the file of interest and select **Re-score Files**. The scoring method not used on the previous pass will be used.
- **Batch Scoring** – This option scores multiple .WAV files using PESQ, POLQA or both. The output of this utility is a delimited text file that may be viewed in raw form, opened in Excel or parsed with a script. This utility can be used to score previously unprocessed files or for re-scoring. Access the **Batch Scoring** utility from the **Data → Utilities** tab.
- **Offline Scoring** – Retrieve and score uplink .WAV files from the Audio Server using either PESQ or POLQA with this utility. Access the **Offline Scoring** utility from the **Data → Utilities** tab.

Appendix F – Nomad HD Hardware



Figure F-0-1 – Spirent Communications HD ME Hardware Unit

The Nomad HD hardware allows for connection to a mobile device via one of three interfaces: Narrowband, High Definition, or Bluetooth.

Important Safety Note

Any usage of the equipment in a manner not specified by the manufacturer may impair features related to safety and user protection.

Tout usage de cet équipement, qui n'est pas conforme aux spécifications du fabricant, peut affecter les fonctions relatives à la sécurité et la protection de l'utilisateur

Nomad HD LEDs

Indicator	Function
L1, L2, L3, L4	<p>Indicates the status of the link over the active interface for the given channel. For example, when utilizing the Bluetooth interface, the LED indicates the status of the Bluetooth link. The general behavior is as follows:</p> <ul style="list-style-type: none"> • Dark – Channel is disabled • Green – Channel is enabled for Narrowband Analog • White – Channel is enabled for Wideband Analog • Cyan (Flashing) – Bluetooth initialization • Cyan (Solid) – Bluetooth initialized • Blue (Flashing) – Bluetooth Pairing “On” • Blue (Solid) – Bluetooth is Paired • Yellow (Flashing) – Outgoing call setup • Yellow (Solid) – Outgoing call in progress • Magenta (Flashing) – Incoming call setup • Magenta (Solid) – Incoming call in

	progress • Red - Overdrive
Pwr	When lit, indicates that power is applied to the unit.

Base Unit Physical Interfaces

Interface	Description
HD1, HD2, HD3, HD4	Interface for High Definition Audio
NB1, NB2, NB3, NB4	Interface for Narrowband Audio
PC	USB interface for communication with the PC
GPS	USB interface for communication with a GPS device. The interface functions as a normal USB port for the PC.
+12V	Power supply interface.

Physical Specifications

Dimensions (H x W X D)	1 5/8 in x 10 1/4 in x 4 7/8 in
Weight	2.2 lbs
Case material	Aluminum
Communication interfaces	Bluetooth, Analog, USB

Power Specifications

AC operations	Requires external AC adapter. Adapter specifications: Input – 100 to 240 V, 50-60 Hz, 0.4 amps Output – 12 V, 1.0 amps
Maximum power usage	10 Watts
Maximum heat dissipation	10 Watts

Environmental Requirements

Operating temperature	0 to 55°C
Storage temperature	-20 to 70°C
Humidity tolerance	5 to 85% RH at 40°C